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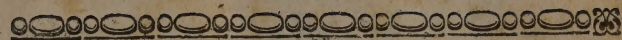
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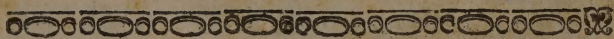








THE  
ANATOMY  
OF THE  
Human Body.



THE  
ANATOMY  
OF THE  
Human Body.

THE  
ANATOMY  
OF THE  
Human Body.

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BY  
WILLIAM CHESELDEN,  
SURGEON to Her MAJESTY,  
F. R. S.

And SURGEON to St. Thomas's-Hospital.

---

*Of all God's Works that do this World adorn,  
There is not one more fair and excellent,  
Than is Man's Body both for Power and Form.*

SPENCER.

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THE FOURTH EDITION.

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With the Addition of an *APPENDIX*,  
which also is printed separately for the Use  
of those who have the former Editions.

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L O N D O N,  
Printed by W. BOWYER;  
And Sold by A. BETTESWORTH and C. HITCH  
at the Red Lyon in Pater-Noster-Row.

MDCCXXXII.



THE  
ANATOMY  
OF THE  
Human Body.

32293



The Fourth Edition.  
With the Addition of an APPENDIX  
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LONDON:  
Printed by W. Howarth,  
And sold by A. BARNARD, at the  
at the End of the Strand.  
MDCCCXXXV.



T O

*Dr. Richard Mead,*

FELLOW of the College of

Physicians in LONDON,

And FELLOW of the

ROYAL SOCIETY.

SIR,



VERY part of PHY-  
SICK may justly pre-  
sume on Your pro-  
tection, to whom it  
owes so much improve-

A 3

ment.

## *The Dedication.*

ment. ANATOMY in particular has received such advantage from Your LECTURES, that it were a kind of injustice not to dedicate all endeavours in that way to You; in me indeed it would be unpardonable not to offer the fruits of those studies, which at first began, and have still been carried on with Your encouragement. The kind reception my industry has met with, is owing to You, the authority of whose opinion has in every place secured me so much favour;



*The Dedication.*

vour; especially in that  
feat of learning, which  
with distinguished honours  
rewarded Your merit. I  
am,

*S I R,*

*Your most obliged and*

*obedient humble Servant,*

*WILLIAM CHESELDEN.*





T H E

# P R E F A C E.



*HIS* treatise being designed for the use of those who study ANATOMY, I have disposed it in the same order in which it is usually taught. The bones first, and then the muscles, because the knowledge of the bones is necessary to the knowledge of the muscles; and afterwards the vessels, because their situations are chiefly described by the bones and muscles, near which they are situated. But before we shew the vessels



## The Preface.

*sels in the limbs, we find it necessary to shew the parts in the three cavities, which I have endeavoured to do in that order which is most convenient to dissect in, and fittest for the explanation of the animal œconomy: But the parts of generation, and the five senses, being fit to be considered separately, they are all done in a distinct book.*

*IN describing of the parts, I have pretty much neglected the Minutiæ in ANATOMY: Nor have I been very particular about those things which cannot be understood without being seen, and being seen need little description; but have endeavoured to be more explicit about those which are of greatest use in PHILOSOPHY, PHYSIC, and SURGERY: And I could wish the dividing and distinguishing of parts were usually done*

## The Preface.

*done with more regard to these valuable ends.*

*I MUST here acknowledge my obligations to Mr. Monro, professor of ANATOMY at Edinburg, who, besides those excellent chapters of the Ductus Thoracicus and the nerves, with other passages acknowledged in their respective places, has sent me so many remarks upon the former editions that there are but few pages in this, which are not the better for him.*

*IN this edition there is no alteration nor addition, except the Appendix; and the plates being worn out, having printed between three and four thousand, I have broke them to pieces, with an intention to make a new set of plates, in which no expence shall be spared: And*  
as

## The Preface.

*as I have taken care to do justice to the buyers of the former editions, by giving them leave to change their books at a low price; so I do intend, if I print another, to act in the same manner.*







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THE







THE  
ANATOMY  
OF THE  
Humane Body.

---

*The General Introduction.*

**I**T is a received opinion, that an animal body is a Compages of vessels, variously disposed to form parts of different figures, for different uses.

THE ancients supposed, that the heart and brain were first formed, and that all the other  
B parts

## *The General Introduction.*

parts proceeded from them, and that all membranes were derived from the Dura Mater, or Pia Mater of the brain. They distinguish'd all the parts into spermatic and sanguineous; and frequently engaged themselves in disputes about the derivation of parts; with many other things of the like nature, consequences of their Hypothesis. But the moderns, assisted with glasses, have discovered, that all the parts exist in miniature, from the first formation of the Fœtus; and that their increase, is only the extension and thickning of their vessels, and that no part owes its existence to another.

THUS much I thought necessary to premise, that the reader might have a general idea of the body, and that he may see for what reason no notice is taken in this treatise of some distinctions and divisions of parts, used by ancient Anatomists, and those who have copied after them.

THE constituent parts of the animal body, are, Fibres, Membranes, Arteries, Veins, Lymphæducts, Nerves, Glands, Excretory Vessels, Muscles, Tendons, Ligaments, Cartilages and Bones; to these may be added the Hair and Nails, tho' they seem to have only a vegetative kind of life.

FIBRES, as they appear to the naked eye, are simple threads of the minutest blood vessels or nerves, or both, which enter into the composition of every part.

MEMBRANES, are Compages of fibres, expanded, to cover, or line any other part.

THE arteries, are tubes that arise in two trunks from the two ventricles of the heart, and thence dividing

## *The General Introduction.*

3

dividing into branches, distribute the blood to every part of the body.

**VEINS**, are tubes to return the blood from the extremities of the arteries to the heart.

**LYMPHÆDUCTS**, are pellucid tubes to carry lymph from all parts, especially the glands, which they discharge into the larger veins, and into the Vasa Lactea.

**NERVES** are Fasciculi of cylindrical fibres, which arise from the Medulla Oblongata of the brain, and the Medulla Spinalis, and terminate in all the sensitive Parts. They are the immediate organs of sensation.

A **GLAND** secretory, is composed of an artery, vein, lymphatic, excretory duct, and nerve. The use of glands is to secrete fluids from the blood for several uses.

**EXCRETORY-VESSELS**, are either tubes from glands to convey the secreted fluids to their respective places, or vessels from the small guts, to carry the chyle to the blood-vessels; these last, are call'd Vasa Lactea.

**MUSCLES**, are distinct portions of flesh, which, by contracting, perform the motions of the body.

**TENDONS**, are the same fibres of which the muscles are composed; but white and more closely connected, that they may possess less space in a limb, and be inserted in less room into a bone.

**LIGAMENTS**, are strong membranes, or bodies of fibres closely united, either to bind down the tendons, or give origin to the muscles, or tie together such bones as have motion.

## *The General Introduction.*

CARTILAGES, or gristles, are hard, elastic, smooth and insensible: Their use is to cover the ends of the bones that have motion, to prevent their attrition, &c.

BONES, are firm parts to sustain, and give shape to the body.

THE hair and nails are sufficiently known; the former seems to be nourished from the *Materia Perspirabilis*, and the latter from the *Reticulum Mucofum*, betwixt the *Cutis* and *Cuticula*.







# BOOK I.

---

## CHAP. I.

### *Introduction to the Bones.*

**T**HE use of the bones is to give shape and firmness to the body, to be levers for the muscles to act upon, and to defend those parts from external injuries that are of greatest consequence to be preserved, as the brain, heart, &c.

THEY are in their first state very soft fibres, till by the addition of a matter, which is separated from the blood into them, they grow by degrees to the hardness of a cartilage, and then perfect bone: But this great change is neither effected in a very short time, nor begun in all the parts of the same bone at once. Flat bones, that

have their fibres directed to all sides, begin to ossify in a middle point; but those that have their fibres nearly parallel, begin in a transverse middle line, that is, in the middle of each fibre; and so the cylindrical bones in a middle ring, from which they shoot forth to their extremities. By the continual addition of this ossifying matter, the bones increase, till their hardness resists a farther extension; and because their hardness is always increasing while they are growing, the increase of their growth becomes slower and slower, till they cease to grow at all; and at length in old or weak persons, if I am not mistaken in my observations, they decrease as well as the fleshy parts, though not so fast, by reason of their hardness. And though I think it would be difficult to prove this, yet the possibility of it at least will sufficiently appear from the following case. A soldier that from a shot in his left groin, had the head of the *Os Femoris* broke, part of which came away through the wound, upon which the limb wasted, and he dying of an *Anasarca* about a year after, I found the *Os Femoris* wasted about an inch in length, but so much in its thickness, that when they were both dried and sawed lengthways through their middles, the emaciated bone weighed thirty grains less than half the weight of the other thigh bone: From the appearance of this man, and the firm connection of all the bones with their *Epiphyses*, I am persuaded he must have done growing before he receiv'd this wound; therefore, unless he was taken lame into the service, which cannot be supposed, this bone

bone must have wasted about thus much in that time. The ossifying matter of the bones is so well directed to them by some wise law, that I have seen but one instance of a bone in an adult body unossified, which was so much of one side of the lower jaw as is beyond the teeth; but bony excrescences upon the bones are frequent, and even the fleshy parts, especially in old persons, are sometimes ossified. In an old man that died of a mortification in his leg, I found all the arteries of the legs bony, especially between the divisions of the branches, and many parts of the Aorta. But the most considerable instance of this kind that I have ever found, is in part of the muscular fibres of the heart of a man, nearer its Vertex than the base, as large as a sixpence, perfectly ossified. And though it might seem that the bones, while they appear cartilaginous, differ from perfect bones only in hardness, yet in a child two years old that I kept in vinegar, all the bones grew near as soft and pliable as the fleshy parts, though the skin in several places was not taken off; yet the cartilages and cartilaginous Epiphyses of the bones were but little altered. Tab. vi.  
F. 1.

BONES that are without motion, as those of the skull, the *Ossa Innominata*, &c. also bones with their Epiphyses, when they meet, press into each other, and form sutures, which soon disappear in those that join, while their ossific matter is soft; but those that grow harder before they meet, press more rudely into each other, and make more uneven sutures, some of which in the skull endure to the greatest age; and very often Tab. iii.

the ossific matter not flowing far enough to complete a bone, the part uncompleted has an ossification begun in its center, and is formed into a distinct bone, which may happen to be of any figure. These bones are oftenest found in the lambdoidal suture, and are called *Offa Triquetra*.

Tab. iii.  
29.

But the ends or sides of bones that are intended for motion, are hindered from uniting, by the cartilages which cover them; for when these cartilages are destroyed they very readily unite; this distemper is called *Anchylosis*.

Tab. vi. E.

THE ends of all the bones that are articulated for very manifest motions, or that are not placed against other bones, are tipped with *Epiphyses*, or additional bones, which in some measure determine their growth and figure; for if they had nothing to give bounds to them, they would shoot out like the *Callus* from the broken ends of a bone that is not set, and grow more ragged than the edges of bones which are joined by sutures; and sometimes *Epiphyses* are made use of to raise processes upon bones for the insertions of muscles, as the *Trochanters* of the thigh bones, where it would weaken the bones too much to have processes raised out of their substance.

Tab. v.  
1, 2, 3.

Tab. ii.  
16, 17.

THE fibres of bones, for ought that we can discover from experiments or microscopical observations, appear to be connected to each other by the same means that the several parts of a fibre are connected, that is, by that strong attraction which belongs to particles of matter in contact: But this cohesion of fibre to fibre is not equal to that in the parts of a fibre, though very nearly,



nearly: Indeed, if it was, a bone would not be a structure of fibres, but one uniform mass, like that of any pure metal, the cohesion of the parts of which are every way alike: Nor are the parts of bones disposed into Lamellæ, Stratum super Stratum, as G—di, and others have painted; for though young bones may in some places be split into Lamellæ, yet they not only appear one solid uniform mass to the naked eye, but even with a microscope, till we come to their inner spongy texture, which also appears uniform.

THE texture of the bones when first formed, is every where loose and spongy, but as they increase, they become in many places very compact and dense, which results in great measure from the pressure of the bellies of the muscles, and other incumbent parts; as appears from the impressions which are made on the surfaces of the bones, and the rough spines that rise on the bones in the interstices of the muscles, which are very remarkable in the bones of men who have been bred up in hard labour. In those parts of the flat bones that receive but little pressure, the outer Laminæ only become compact and dense, and the middle part remains spongy; but where the pressure is great, they become one dense body or table; and this pressure is so effectual, that some parts of the Scapula, and the middle of the Ilium, are usually thinner in an adult body than in a child before it is born. The cylindrical or round bones being pressed most in their middle, become there very hard and strong, while their extremities grow spongy, and dilate Tab. v. D.  
into

into large heads, which make stronger joints, and give more room for the origins and insertions of the muscles; and increase the power of the muscles, by removing their Axis farther from the center of motion of any joint they move.

ALL the bones, except so much of the teeth as are out of the sockets, and those parts of other bones, which are either covered with cartilage, or where muscles or ligaments arise or are inserted, are covered with a fine membrane, which upon the scull is called Pericranium, elsewhere Periosteum; one use of which is for the muscles to slide easily upon, and to hinder them from being lacerated by the roughness and hardness of the bones. This membrane is said to be exceeding sensible of pain, which, I suppose, is imagined from the pain that a blow on the shin gives; but it should be considered how much greater the contusion is in that case, from its lying upon a hard body; for this is certain, that when we cut this membrane, or separate it from the bone, as we do, to prepare for the operation of the trephine; the patient never discovers any extraordinary uneasiness; and that great pain which is sometimes felt at the sawing the bones or a bone in an amputation, is when the teeth of the saw touch the great nerves that always lie near the bones, and not from the Periosteum; for if it proceeded from that, this complaint would be more constant, and at least as great at the first setting on of the saw, or at the last stroke, as at any other time.

IN a body that I dissected, who died of a spotted Fever, I found in many of the bones extravasated blood; and in several places, particularly on the Os Humeri, and Os Femoris, a large quantity of blood between the Periosteum and the bones. I imagine it may be from such extravasations of blood that carious bones sometimes follow violent fevers, and the small-pox.

IN children that have died of the rickets, I have always found the nodes on the bones very spongy and bloody, and in one instance several of the bones as limber as leather, and the Periosteum in many places ten times its natural thickness; but the cartilages in all that I have dissected, have had no apparent alteration in their texture, though they were swelled to more than four times their natural bigness.

EVERY cylindrical bone has a large middle Tab.v.D. cavity, which contains an oily marrow, and a great number of lesser cells towards their extremities, which contain a bloody marrow; this bloody marrow is also found in all spongy cells of bones. The use of the first kind of marrow is to soften, and render less brittle the harder fibres of bones among which it is seated; and the other marrow is to be of the same use to the less compact fibres, for an oily marrow might have made them too soft; and for this reason, there is less of the oily marrow, and more of the bloody in young bones than in old ones. Every one of these cells is lined with a fine membrane, and the marrow in the larger cells is also contained in thin membranous vesicles, in which membranes

branes I suppose those vessels lie that secrete the marrow; if the bones had been formed of the same quantity of matter without any cavities, they would if they were streight be able to sustain the same weight that they now can. But they being made hollow, their strength so as to resist breaking transversly is encreased as much as their diameters are encreased, without encreasing their weights; which mechanism being yet more convenient for birds, the bones of their wings, and for the same reason their quills, have very large cavities. But the bones in the legs of all animals are more solid, being formed to support weight; and mens bodies being supported but by two limbs, the bones of their limbs, are therefore made more solid than those of quadrupeds. But in a fractured bone, in which the same kind of matter that ossified the bones at first, is thrown out from the ends of the broken bone, there is made a mass of callous matter of equal solidity with any part of the bone, and of equal or greater diameter; which will make the strength of the bone in that place greater than it was before: And if we consider, we shall find this a very wise provision, for bones, when broke, are seldom or never set in so good a direction as that in which they were first formed, and therefore they would be more liable to be broke in the same place again, and would be reunited with greater difficulty, and sometimes not at all, because the Callus not being vascular, would scarce admit the ossific matter to flow through it to form a new Callus.



THE names of the articulations of the bones being variously used by authors, and being but of small consequence, I give the shortest account that I can of them. An articulation for manifest motion, is called *Diarthrosis*; for obscure motion, *Synchondrosis*; and that kind which is without motion, *Synarthrosis*.

*DIARTHROSIS*, is divided into two kinds, viz. *Enarthrosis* and *Ginglymus*. *Enarthrosis* is where a round head is received into a round cavity, which mechanicks call the ball and socket; though none of the articulations in a humane body fully resemble that, unless the upper end of the thigh bone, with the *Os Innominatum*. *Ginglymus* is always described by authors to be where a bone receives, and is received; which is right, where they are joined somewhat like hinges, as the oblique processes of the *Vertebræ* of the loins, where authors usually take two joints to make a *Ginglymus*, that it may answer their descriptions, tho' any one of those joints is a true *Ginglymus*. But in the other *Vertebræ*, and in the articulation of the *Ulna*, with the *Os Humeri*, and that of the *Radius* with the *Ulna*, there being only the motion of hinges, without the form to give these joints this denomination; we may for the same reason call every joint a *Ginglymus*, whose property is only to bend and extend, as the knee, ankle; &c. And what makes it more necessary to bring these joints under this head, is, that they are reducible to no other.

SYNCHON-

SYNCHONDROSIS, is by intervening cartilages or ligaments, as between the bodies of the Vertebrae; but the truest Synchondrosis is the joining of the ribs to the bone of the Sternum.

SYNARTHROSIS, is of two sorts, viz. Sutura and Gomphosis. The first kind is the mutual indentation of one bone with another, as is eminently seen in the skull, and the other the fastening of the teeth in their sockets, like a nail in wood.

## C H A P. II.

### *Of the Sutures and Bones of the Head.*

THOSE Sutures which have proper names, are here described; those which have not, derive their names from the bones they surround, and are known by them.

Tab.iii. 1. SUTURA CORONALIS, runs across the skull, and joins the parietal bones to the frontal.

Tab.iii. 2. SUTURA SAGITTALIS, joins the parietal bones; it begins at the Os Occipitis, and is continued to the Os Frontis; in children down to the nose; the Os Frontis in them being two bones,

Tab. v. and sometimes so in adult bodies.

Tab.iii. 3. SUTURA LAMBDROIDALIS, joins the back part of the Offa Bregmatis, or parietal bones, to the upper part of the occipital: In this suture are

## *Of the Bones of the Head.*

15

frequently observed small bones, called *Ossa Triquetra*. Tab. iii. 29.

*SUTURA SQUAMOSA*, is made by the wrapping of the upper part of the temporal and sphenoidal bones over the lower edges of the parietal bones. Tab. iii. 4.

*SUTURA TRANSVERSALIS*, runs across the face, through the bottoms of the orbits of the eyes; it joins the lower edge of the frontal bone to the *Os Sphenoides*, *Maxillæ Superioris*, *Ossa Ungues*, *Palati*, *Plana*, and *Jugalia*, or *Maxilarum*. Tab. iii. v.

THE scull being thus divided into many bones, is neither so subject to fractures, nor to have fractures so far extended, as it would have been were it composed of one bone only. This structure is also convenient for the ossification of the bones (as has been shewn in the first chapter) and for the birth, because these bones not being perfect at that time, may be pressed together and make the head less.

TEN of the bones of the head compose the scull to contain the brain. These shall be first described.

*Ossa PARIETALIA* or *BREGMATIS*, are two large bones which compose the superior and lateral parts of the scull; on the inside they are remarkably imprinted by the arteries of the *Dura Mater*. Tab. iii. 7. Tab. viii. 4.

*Os FRONTIS*, makes the upper and fore-part of the Cranium; its lower parts compose the upper parts of the orbits of the eyes. On its inside are impressed the external figure of the two hemispheres. Tab. iii. 6.

hemispheres of the brain. In thin skulls this bone has usually a large thin spine in the middle of the inside, running from the *Os Ethmoides* towards the crown of the head; but in thick skulls it is frequently wanting, and in very thick ones usually a Sinus in its place; the use of this spine is to strengthen thin skulls. Immediately above the *Os Ethmoides* in this bone, is a small blind hole, through which runs a vein into the beginning of the longitudinal Sinus of the *Dura Mater*; between the eyebrows in this bone, are two or three large Sinuses, and sometimes four or five, which lead into the nose; and on the upper edge of each orbit, a small perforation, or a notch, through which nerves and an artery pass secure to the forehead: It has also a small hole in each orbit near the *Os Planum*, through which passes a branch of the fifth pair of nerves. The Sinuses and spine in this bone make it very dangerous, if not impracticable, to apply a trephine on the middle and lower part of the forehead.

*OS ETHMOIDES* OR *CRIBRIFORME*, is a small bone about two inches in circumference, seated in the anterior part of the basis of the skull, being almost surrounded by the last described bone; it is full of holes like a sieve, through which it is said the olfactory nerves pass, which I could never discover. In its middle arises a large process named *Crista Galli*: And opposite to this a thin one which in part divides the nose. The greater part of the *Laminae Spongiosæ* in the nose, belong to this bone.

Tab. viii.  
23.



OS SPHENOIDES, is of a very irregular figure; it is seated in the middle of the basis of the scull, bounded by the Os Frontis, Ethmoides, Vomer Occipitis, Maxillæ Superioris, Offa Parietalia, Palati, Malarum, Temporum, and Petrofa, which are parts of the former bones. In its inside next the brain is a cavity, named Sella Turcica, which is bounded by four processes, called Clinoides; and opposite to the Sella Turcica is a process which makes part of the Septum Narium. On the outside of the scull adjoining to the upper jaw, are two processes of this bone on each side, named Pterygoides, from which arise one on each side near the palate, having no name; over which are reflected the tendons of the Pterygostaphylini Externi muscles; and nearer towards the Occiput, between these and the Styloid processes of the Offa Petrofa, arise two more small rugged processes; and under the Sella Turcica in this bone, is a Sinus or two which open into the nose, and in some sculls only such a spongy substance as is seen in the ends of some of the bones. At the inside of the basis of the two anterior clinoid processes are two round holes, which are the first Foramina of the scull; thro' these the optick nerves pass; almost under these, towards the Sides of the scull, are two irregular slits, named Foramina Lacera, or the second Foramina of the scull, through which pass nerves and blood-vessels into the orbits of the eyes; and under these towards the Occiput are two round holes, which are the third Foramina, through which pass nerves to the face. About half an inch

Tab. iii.

14.

Tab. viii.

18.

Tab. iv.

B. 10.

- nearer the Occiput, are two more of an oval figure, which are the fourth Foramina, through which pass the largest branches of the fifth pair of nerves; and a straw's breadth farther two very small ones, called the fifth Foramina, through which those branches of the carotid arteries enter that are bestowed upon the Dura Mater. Between this last described bone and the *Ossa Petrosa*, are two large rough holes, in which I have seen large veins; and from these holes through part of the *Os Sphenoides*, under the Pterygoid processes are small holes, through which pass nerves and arteries to the back part of the nose.
- Tab. iii. 9. *OSSA TEMPORUM*, are situated below the parietal bones, at the middle and lower parts of the sides of the skull; they have each at their back-parts, one large process, called *Mammillaris*, or *Mastoideus*, and from the lower and middle parts of each a process which joins the *Ossa Malarum*, named *Jugalis* or *Zygomaticus*.
- Tab. iii. 10. *OSSA PETROSA*, lie between the former bones and the occipital bones, or are truly portions of the former bones, being never found separate in adult bodies. They have each on their outside one long slender process, called *Styliformis*, and from the side of this process a Foramen, which runs obliquely forwards into the skull; these are the sixth Foramina; and one Foramen in the inside of the skull leading to the organs of hearing, which are the seventh Foramina.
- Tab. iv. B. 5. The ridge on the upper parts of each of these bones in the inside of the skull, as also on each side raised by the *Os Frontis* and *Sphenoides*,
- Tab. viii. 15.

help to keep the brain steady, (see chapter of the Dura Mater) and are admirable supports to the thin and flat parts of the scull, which else would be exceeding weak. (For what remains of this bone, see chap. Of the organs of hearing.)

BETWEEN the last described bones, and the following bone, are two large holes, which are the eighth Foramina. Through these holes pass <sup>Tab. iv.</sup> the Par Vagum and Lateral Sinuses; sometimes <sup>14.</sup> there are two on each side, one for the nerve, and one for the Sinus. To these we may add another very small one on each side, through which pass the Portiones Duræ of the auditory nerves; and sometimes there is another for an artery.

OS OCCIPITIS, makes all the back-part of <sup>Tab. iv. 2.</sup> the scull; it is bounded by the sphenoidal, temporal, petrosal, and parietal bones; it has two small Apophyses, by which it is articulated to the <sup>Tab. viii.</sup> spine; near those Apophyses are two small Foramina, which are the ninth of the scull; through <sup>Tab. viii.</sup> these pass the ninth pair of nerves; and between <sup>10.</sup> these is the great, or tenth Foramen, through which the Medulla Oblongata descends into the <sup>Tab. iv.</sup> spine, the cervical arteries enter, and the cervical <sup>B. 15.</sup> veins and tenth pair of nerves pass out. In the inside of this bone is a crucial spine impressed by the longitudinal and lateral Sinuses; and on the outside opposite to the middle of this spine, in some bodies, is an Apophysis, and from that <sup>Tab. viii.</sup> down to the great Foramen, a small thin spine. <sup>7.</sup> The spines in this bone are of the same use with those in the Os Frontis, &c. viz. to strengthen it, which they do here in a greater degree than

## *Of the Bones of the Head.*

in any other bone of the scull. The thinner parts of this bone are also defended by the muscles that cover them. This provision is very necessary, because we can least defend this part, and blows here are of worse consequence than on any other part of the scull, because wounds in the Cerebellum, which is underneath, are mortal. There is in most sculls, a Foramen behind each Apophysis of the occipital bone to the eighth Foramen; through which pass Sinuses, from the lateral Sinuses, to the external cervical veins: By means of these communications, as in all other communications of the Sinuses, the blood passes from those that happen to be surcharged by any posture of the head, into those that from the same posture would else have been almost empty. Such sculls as want these Foramina, have two Sinuses for the same purpose within the scull.

THE remaining bones of the head compose the face, orbits of the eyes and the jaws.

Tab. iii.  
16. *Ossa Nasi*, are small oblong bones which make the upper part of the nose; they make that kind of arch which is fittest to sustain such injuries as the nose is most exposed to.

Tab. iii.  
15. *Ossa Malarum*, these bones compose the cheeks, and the anterior, lower and outer parts of the orbits of the eyes; they have each a short process, which processes join the *Processus Jugales* of the temporal bones, and form arches which by some Authors, have been called *Ossa Jugalia*.

Tab. iii.  
17. *Ossa Ungues*, are small bones about as large as thumb nails, seated immediately below the *Os Frontis* towards the nose in the orbits of the



the eyes, whose anterior and inner parts they help to compose; and between each of them and the upper jaw is a Foramen as large as a goose quill, <sup>Tab. iii.</sup> into which the Puncta Lacrymalia lead, to carry <sup>19.</sup> off any superfluous moisture from the eyes into the nose.

OS SA PLANA, are thin smooth bones seated <sup>Tab. iii.</sup> immediately beyond the foregoing bones, in the <sup>18.</sup> orbits of the eyes, and are near thrice as big. They are indeed, but smooth surfaces of the Os Spongiosum, and not distinct bones.

MAXILLA SUPERIOR, is always described <sup>Tab. iii.</sup> single, though it is manifestly divided by a su- <sup>20.</sup> ture which is scarce ever wholly obliterated. It runs up with two processes to the Os Frontis between the Ossa Nasi and Ungues, and another, which joins to the cartilage of the Septum Nasi. Its upper and outward parts make the lower parts of the orbits of the eyes; its lower side, all that part of the face under the cheeks, eyes, and nose to the mouth, and two thirds of the roof of the mouth. A little below the orbits of the eyes, in <sup>Tab. iii.</sup> this bone, are two holes, and behind the Dentes <sup>21.</sup> Incisores one more, which divides into two, as it opens into the nose, one on each side the Septum Nasi. Between the posterior grinding-teeth and the orbits of the eyes are two great Sinuses, called Antra Maxillæ Superioris: and in the lower edge of this jaw are the Alveoli, or sockets for the teeth. Part of the sides of these cavities, that lie next the nose, are only membranes which make the cavities like drums, perhaps to give a grave sound to the voice when we let part of it

through the nose; but brutes not needing such variety of sounds, have these cavities filled with *Lamellæ*, which are covered with membranes in which the olfactory nerves terminate, for a more exquisite sense of smelling, than is necessary for men.

I HAVE seen an imposthumation from rotten teeth in one of these cavities, which has been cured by drawing some of the last grinding-teeth, and by making a perforation into it through their sockets. Mr. Cowper has admirably described this case. The signs of it are rotten teeth, stinking breath, and great pain about the part. The drawing one or two of the last grinding-teeth, generally, if not always, in this case, opens a passage into the Antrum; but if not, or if the passage is not large enough, it may be made or enlarged with a carpenter's nail-piercer or gimblet, which is as good an instrument as can be for the purpose.

*OS SA PALATI*, are two small bones that make the back part of the roof of the mouth, and a small part of the bottom of each orbit, unless these portions may be accounted distinct bones. Between the *Ossa Palati* and the *Ossa Maxillare* near the pterygoid processes of the sphenoidal bone, are two small Foramina, through which arteries and nerves pass to the palate.

Tab. viii.

24.

*OS VOMER*, is seated between the bones of the palate, and the sphenoidal bone. It is also joined to the process of the *Ethmoides*, and part of the lower jaw. Its fore-part is spongy, and is

continued

continued to the middle cartilage of the nose. This bone and cartilage are the Septum Nasi.

Os SPONGIOSUM, is usually treated as a distinct bone, though it is only the spongy Laminæ in the nose, of the Os Ethmoides and Offa Plana, but chiefly of the Os Ethmoides, to which it always adheres. In considering these Lamellæ as a distinct bone, we follow the ancients, who did not distinguish the bones of the skull only, as they are divided by Sutures, but according to the differences of their texture, figure, situation, or use. Thus they called these parts, Os Spongiosum; a process of the temporal bone, joined to the Os Malæ, Os Jugale; the temporal bone, which is one with the Petrosium in adults, Os Temporis, because it is seated under the temples; and the other parts, Os Petrosium, from its hardness or ruggedness; and the upper jaw one bone, though it is always two.

MAXILLA INFERIOR, is articulated with Tab. iii. loose intervening cartilages to the temporal<sup>22</sup>. bones, by two processes, named Condylodes. Tab. iii. Near these arise two more, very acute, called<sup>24</sup>. Coronales, and at the inside of the chin a small Tab. iii. rough Processus Innominatus. In the inside of<sup>23</sup>. this bone under each Processus Coronalis, is a large Foramen which runs under the teeth through this bone, and passes out at the chin. Tab. iii. In this Foramen or chanel, the vessels pass<sup>25</sup>. that belong to the teeth; and in the upper edge of this jaw are the Alveoli, or sockets for the teeth.

*Of the Bones of the Head.*

DENTES, the teeth seldom exceed sixteen in each jaw; the four first in each are called Incisores, the two next Canini, and all the rest Molares; the four last of these are named Dentes Sapientiaë, because they do not appear till men arrive at years of discretion. The Incisores and Canini have only one single root, but the Molares more; the eight first, two; and the rest, some three, some four; especially in the upper jaw, because the upper jaw being more spongy than the other, the teeth need more fangs to fix them. Each of these fangs, or roots, has a Foramen, through which pass an artery, vein, and nerve; which are expanded in a fine membrane lining a cavity in each root of a tooth. This membrane is the seat of the tooth-ach.

THE teeth of children cast off while they are growing; but the succeeding teeth arise in new sockets, and larger than the former; for the jaws increasing faster than the teeth, must otherwise of necessity have left chasms between them, such as there are in the mouths of brutes; but where teeth are drawn in adult bodies, the sockets close, and new teeth very rarely arise.



## C H A P. III.

*Of the Bones of the Trunk.*

THE bones of the trunk are those which compose the spine or chain of bones from the head down to the rump, the ribs and Sternum.

THE spine, is composed of twenty four Vertebrae, (each of which in a young child is three bones) besides those of the Os Sacrum and Coccygis; seven belong to the neck, the first of which is called Atlas, the second Dentata, from a process in that bone bearing the same name; twelve to the back, five to the loins: The Os Sacrum is sometimes five, sometimes six bones, and the Os Coccygis four. If this chain had been composed of fewer bones, they must have either not been capable of bending so much as they do, or have bent at less obtuse angles, which would have press'd the spinal marrow.

IN all these Vertebrae, except the first, is a middle anterior spongy body, by which they are firmly articulated with a very strong intervening ligament; and from the middle of the hind part of each, except the first, stands a process named Spinalis, and from every one a process on each side, called Transversalis, and two superior, and two inferior short ones; by which the back parts

of

Tab. i. ii.

Tab. iv. G.

Tab. iv.  
H. I.

Tab. iv.

H. I. K.

1.

4.

2.

3. of the Vertebrae are articulated, named *Obliqui, Superiores, and Inferiores.*

THE fore-part of the seven Vertebrae of the neck, and two upper of the back, are flat forwards, to make room for the *Aspera Arteria and Gula*: The third and fourth of the back very acute, to give way to the division of the vessels of the lungs and heart, and bent to the right side for the situation of the heart, which makes that side of the breast somewhat more convex than the other, and therefore I think stronger; which is an advantage to the right arm, because its motions depend upon the support it receives from the breast.

HENCE, I think, it seems that the almost universal preference of that arm is not an arbitrary thing, but founded upon observation, that it is capable of more perfect actions than the other.

THE spinal processes of the second, third, fourth and fifth Vertebrae of the neck are forked, the two last of the neck long and horizontal, the three or four upper ones of the back like them, only a little declining, the middle ones of the back run obliquely downwards, and the processes of the remaining Vertebrae become successively thicker, stronger, and less declining; those of the loins being horizontal, like the last of the neck. The muscles that are inserted into the spinal processes of the Vertebrae of the neck and loins, will act with more strength than those of the back, because their processes being perpendicular to the spine, they are longer levers; besides,

sides, those of the back touch one another, and prevent much motion, because it would interrupt respiration; and much motion being necessary in the neck and loins, their processes are made fit for it.

THE transverse processes of the *Vertebræ* of the neck are perforated, for the admission of the cervical blood-vessels, and bowed downwards, and hollowed, for the passage of the cervical nerves. The eight or nine upper ones of the back, receive the upper ribs; and the rest, with those of the loins, serve only for origins and insertions of muscles. The shape of the spine is like an *Italick f* bending inwards at the loins, and outwards at the shoulders; therefore when women that are either very young or very weakly, breed, the child by a continual pressure against the loins, makes them straighter, which necessarily makes the shoulders or back so much more convex, and the pressure upon the abdominal muscles at the same time bringing the ribs downwards, they grow round-shouldered and flat-breasted.

OS SACRUM has two upper oblique processes, some small spinal processes, and two Foramina in each interstice of the bones it is composed of, both before and behind. Tab. ii. 13.

OS COCCYGIS has none of these parts.

THROUGH every bone of the spine, the Os Coccygis excepted, is a large Foramen, which together make a chanel through the spine, in which is contained the *Medulla Spinalis*; and in each Tab. ii. 14.

each space between the Vertebrae are two large holes for the nerves to pass out.

'Tis worth considering, the provision that is made to prevent luxations in this chain of bones, such luxations being worse than any other because of the spinal marrow which is contain'd within these bones. The bodies of the Vertebrae are all in the same manner connected by strong intervening ligaments or cartilages. In the neck the oblique processes of the received bone are wrapped over those of the receiving bone, which forbids their luxating forwards. The transverse processes with a small Apophysis of the body of the same bone, in like manner, secures 'em from slipping backwards, and an Apophysis on each side of the body of the receiving bone, hinders them from slipping to either side. The Vertebrae of the back are hindered from dislocating forwards by the same provision with those of the neck; and from luxating backwards, by the ribs which are fastened to the transverse processes of the inferior Vertebrae, and against the back-part of the body of the next superior; they also hinder them from dislocating to either side; but the ribs at the two or three last Vertebrae of the back are not fixed to the transverse processes, and therefore it is that luxations are most frequently seen in this part; but the Vertebrae of the loins are received into deep cavities, and are tyed with much stronger ligaments for their security. Each joint of the Vertebrae, except the two uppermost, has two centers of motion, one upon the bodies of the Vertebrae, when the body is bowed forwards;  
and



and the other at the articulations of the oblique processes, when the body is bowed backwards; from which structure the extensors will have about twice the lever to act with, and consequently twice the power to raise the trunk into an erect posture, that they have to carry it beyond that posture; for then the oblique processes begin to be the centre of motion, and give the same advantage to most of the benders. Without this contrivance it would have been more difficult, if possible, to have kept the body erect for any length of time, or to have recovered an erect posture with considerable strength after a bend of the body.

THE ribs are twelve in number on each side; Tab. i. ii. the seven uppermost are called true ribs, because their cartilages reach the Sternum; and the five lowest are called bastard-ribs. They are articulated to the bodies of the twelve Vertebrae of the back, and all except the two or three last are articulated to their transverse processes, and the under side of the middle ribs are hollowed for the passage of the intercostal vessels. They defend the parts contained in the breast, and when they are drawn upwards, the cavity of the breast is enlarged for inspiration, and so the contrary. In two children which I have dissected, I found the ribs broke inwards, and on the outside a plain print of a thumb and four fingers, which had been made by their nurses hoisting them up on one hand, taking hold of their breasts, which being very often repeated, had broke the ribs inwards like a green stick, without separating the broken ends

ends of them; and I have very frequently seen the shape of childrens breasts quite spoiled by such tricks, which has occasioned weakness of body, crookedness, and other Diseases.

Tab.i.2. STERNUM, or breast-bone, is generally made up of three spongy bones, sometimes more; to this the true ribs are articulated by their cartilages. See chapter of the cartilages.

Tab.iv.C. OS HYOIDES (I chuse to mention it in this place, because I know none more proper among the bones) is a small bone at the root of the tongue; it serves only for muscles to arise from, and be inserted into. It is made of three bones, the middle one is called Basis, the other Cornua.

1. I HAVE seldom found fewer than four and twenty Vertebrae in the spine, besides the Os Sacrum, but often more; sometimes thirteen of the back, with as many ribs of a side; and sometimes six in the loins: And in some bodies two ribs from the first Vertebra of the loins; but then it has wanted transverse processes.
- 2.

A WOMAN in the hospital with the venereal disease, having several bones carious, among the rest two of the Vertebrae of the neck had their spongy bodies corroded, which separating from their other parts while she was in a salivation, her head could no longer be sustained, but bowing forward, the spinal marrow was compressed and she died soon after.

## CHAPTER IV.

### *Of the Bones of the upper Limbs.*

**CLAVICULA**, is of the figure of the Italick Tab. i. 3. *ſ*, one end is articulated to the Sternum, and <sup>ii. 3.</sup> the other to the Proceſſus Acromion of the Scapula; it ſerves to fix the Scapula, and to determine its motions. This bone is oſſified as early as any bone in the body, and is the ſoonest united when broken.

**SCAPULA**, its parts are the Acetabulum, Tab. ii. 4. which is a ſhallow cavity to receive the Os Humeri: A large ſpine from whoſe fore-part ſtands a proceſſus called Acromion, and another proceſſus Tab. ii. 5. from the fore-part of the upper edge of the Scapula named Coracoides; its upper edge is named Coſta Superior, and its lower one Coſta Inferior, and the poſterior edge its Baſis. I have ſeen a Scapula of a man which Dr. Douglafs diſſected, in which the inſide of the Acetabulum Scapulæ was broke all to pieces, and the Os Humeri diſplaced; which fracture, I believe, could not by any means be certainly known while the Man was living, or if it could have been known, could not have been cured; yet I doubt not but the ſurgeon, whoever he was, did not eſcape cenſure for not making a cure.

WHENEVER

WHENEVER the Proceſſus Acromion is broke, the arm can never after be raiſed to advantage; for no care of the moſt ſkilful ſurgeon can reduce ſuch a fracture; for the Deltoid muſcle will draw the ends of the broken proceſs aſunder, and will want a middle fixed place to act from.

Tab. i. 5.  
ii. 6.

OS HUMERI, this bone has at its upper end a round head for its articulation, and near that an Apophyſis, which is divided by a Sulcus, in which runs a tendon of the Biceps Flexor Cubiti. At its lower end are two Apophyſes, named the outer and inner. Between theſe Apophyſes on the fore-part of the bone, is a ſmall Sinus, which receives a protuberance of the Ulna, and behind a large and deep one, which receives the Olecranon of the Ulna. This bone being more liable to be broke by a blow than any other way, and it being uncertain where that ſhall fall, it is made of almoſt equal ſtrength through the whole length of it; and its lower end having a very ſmall joint, for the ſake of a quick motion, the Sinuſes are formed there, to receive the proceſſes of the Ulna, to prevent diſlocations.

Tab. i. 7.  
ii. 8. ULNA, at its articulation to the former bone has two proceſſes, one large and thick, named  
Tab. ii. 9. Olecranon, and one ſmall one, named Proceſſus Anterior, and at the lower end of this bone is a ſmall proceſs, named Styloides.

WHEN about two inches or leſs of this bone is broke off at the lower end, it is ſcarce poſſible to raiſe it into its natural ſituation till the arm be turned prone; becauſe in a ſupine poſture the tendon



## *Of the Bones of the upper Limbs.*

33

don of the Tensor Ulnaris rides over it, and presses it down.

**RADIUS** is received at the upper end by the *Tab. i. 6.*  
*Os Humeri* and *Ulna*; at its lower end it receives the *Ulna* and *Carpus*. *ii. 7.* By its turning upon the *Ulna*, are performed the prone and supine motions of the cubit. About an inch below its upper end is an extuberance for the insertion of the *Biceps* muscle.

**CARPUS** the wrist, is composed of eight bones *Tab. iv.*  
of irregular figure; they are distinguished into *M. 1, 2, 3,*  
four of the first order, and four of the second. *4, 5, 6, 7, 8.*  
The two first of the first order are articulated with the *Radius*, the first of the second order is articulated to the thumb, and the remaining three to the metacarpal bones. The inside of these bones leave a semilunar cavity for the tendons of the muscles which bend the thumb and fingers to pass through. What other reasons there may be for this particular composition of bones, I know not; but this is plain, that by being moveable, one among another, they gradually give way, and lessen the shock which any force against the hand would give, as the box of springs does the jolting of a coach, and thereby make the force less in each moment of time upon every bone of the arm, which greatly preserves them from breaking; and the *Scapula* being fixed by muscles, contributes very much to this purpose. This is an advantage that cannot be exactly computed; but it is certainly very great.

**METACARPUS**, is composed of four bones. *Tab. iv.*

**POLLEX**, the thumb is made of three bones. *M. 9.*

D

**DIGITI**, *M. 10.*

Tab. iv.  
M. 11.

**DIGITI**, the fingers are each composed of three bones. For the figure of these, see the Table, which will give a better idea of them than a verbal description.

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## C H A P. V.

### *Of the Bones of the lower Limbs.*

Tab. i. 11.  
ii. 12.

**OS INNOMINATUM**, is, before puberty, composed of three bones; the uppermost is named Ilium, the lower and anterior Os Pubis, the lower and posterior Os Ischii. The upper edge of the Ilium is called its spine, the anterior part of the spine its Apex, and lower than this is the Proceffus Innominatus. The Ischium has two proceffes, the one called Acutus, the other Obtufus. In the center of these bones is the Acetabulum, or socket, to receive the thigh-bone; in the bottom of which socket is another cavity, in which lies the lubricating gland of this joint;

Tab. i. 19. and between the Os Ischium, and Os Pubis, is a large Foramen.

Tab. i. 12. **OS FEMORIS**, at its upper end has a round head which is received into the Acetabulum of the Os Innominatum. A small distance from this

Tab. i. 13. are two proceffes, named Trochanter Major, and  
ii. 17. Trochanter Minor. The space between the greater

Tab. ii. 17. proceff and the head of this bone is called its neck, and from the lesser Trochanter down the back-

back-part of this bone till within four or five inches of the lower end, is a ridge, called *Linea Aspera*. At the lower end of this bone are two Apophyses, one exterior, and one interior. The chief use of the *Linea Aspera* is, to strengthen the thigh-bone; it is therefore so ordered, that it is always large, proportionably to the bend of the thigh-bone, and largest in that part of every thigh-bone that is most bent.

IN two bodies which I have dissected, I have Tab. iv.  
G, H. found this bone broke at its neck, and by that means the limb shortened, and the case mistaken for a luxation of the hip; and if we consider the depth of this articulation, and the wonderful strength both of the muscles and ligaments, we cannot but suspect that this bone is much oftener so broke, than out. This is certain, that if by an external accident the thigh is made shorter, and yet is useful, that must needs be from a fracture, and not a dislocation; for it cannot be, that the head of the thigh-bone should form itself a socket among the muscles, to bear the whole weight of the body: Or supposing this could happen, though it is contrary to what we know in other like cases, yet even then we must have new muscles made, or these we have altered; for their directions with the thigh-bone being changed, their uses would too, and almost all pull to the side contrary to which the bone is dislocated.

It often happens, that from a flux of humours upon the hip, this joint appears dislocated; for when it is attended with pain, the muscles contracting alter the posture of the limb, and make

## *Of the Bones of the Trunk.*

it appear shorter, as the limb which is lifted from the ground is when we stand on one leg: But if the fluxion is without pain, the muscles relax, and the limb falls into the same figure, which that limb is in, which we stand on in that posture, and appears longer; which makes the common way of comparing of the limbs a very uncertain, if not impossible way to discover the case; therefore to know certainly, apply a straight rule from the Apex of the spine of one hip to that of the other, then from the middle of that rule draw a perpendicular line between the legs, then measure the limbs at that line in the same plane, and if their Lengths are equal, they are most certainly right.

Tab.i. 14. **PATELLA**, the knee-pan, is seated upon the joint of the knee; its use is for the extensors of the Tibia to be inserted into, lest passing over that joint, they might be too much exposed to external injuries; it also gives an advantage to the muscles, by removing their Axis farther from the center of motion of the knee.

Tab.i. 18. **TIBIA**, the shin-bone is in its middle almost triangular, which it seems to owe to the pressure of the muscles, for it is cylindrical in a Fœtus. In its upper end are two shallow sockets, between which is a process for the cross ligament of the knee to arise from; a little below its Head is another process, to which the ligament of the Patella is fixed, and at its lower end another, which makes the inner ankle.

A Boy of seven Years old was brought to me with both the Epiphyses at the upper ends of the  
Tibiæ,



**Tibia**, so far separated from the Tibiæ, that not more than half each Tibia was joined to half the Epiphysis, which made the legs wholly useles. This had been occasioned by the nurse holding him out to stool by the heels and back, when very young, which is among them too common a practice. I dissected the leg of a man that had broke the Tibia through the flesh, by a fall from the top of a house; no extension that was made moved this compound fracture at all, which I afterwards found to be occasioned by a simple transverse fracture above, which always gave way to the extension; that bit of bone whose end came through the skin, being discontinued from the parts by which the extension was made. In the foot of the same Leg, four of the bones of the Tarsus were cracked, two more of them, viz. the Os Calcis and Naviculare, had large pieces separated, which were broke into a mash; and all this without any dislocation among these bones, or any the least external wound or bruise.

**FIBULA**, is a long small bone, its upper end Tab.i. 16. is articulated to the outside of the Tibia, an inch ii. 19. below its joynt, and the lower end makes the outer ankle, and part of that joynt; its chief use is for origins of muscles; for it has no share in supporting the body. A strain of the worst kind happens often to this joynt from the mighty force of the Peronei muscles, when we endeavour to prevent a fall; for they being turned over the end of the Fibula, as on a pulley, part of their force lies against this bone, and strains the ligaments that hold it, and sometimes the bone it self is

broke by them; which wants no care to set, and can seldom be discovered till the swelling is fallen.

Tab. iv. L. 1, 2, 3, 4, 5, 6, 7. **TARSUS**, is made up of seven bones, which are called Astragalus, Os Calcis, Naviculare, Cuboides, Cuneiforme, Majus, Medium, and Minimum. The bones of the Tarsus have the same kind of elastick structure with those of the Carpus, and for the same ends, but in a much greater degree; because here the whole body is sustained. This sort of contrivance, and the use of it, are both very evident in the last joynts or pasterns of the legs of horses; for horses that have long pasterns, and much elastick motion in them, must necessarily trot high, and yet they always trot easie; but a horse with short pasterns, that trots high, always trots hard.

AN old man that had the under part of the Os Calcis laid bare as large as a half-crown, by a mortification, being brought to the hospital about two years after the bone was first bare, and all endeavours to scale it having proved ineffectual, I pared it with a chisel till the bone bled, and it covered with granules of flesh, in about three days, and afterwards healed very easily.

Tab. iv. L. 8. **METATARSUS**, is composed of four bones.

Tab. iv. L. 9. **POLLEX PEDIS**, is composed of three bones.

Tab. iv. L. 10. **DIGITI PEDIS**, each is composed of three bones, but the two last of the little toe often grow into one.

FOR the figure and situation of these bones, see the table.

OSSA SESAMOIDEA, are said to be found to the number of forty-eight: But we commonly find no more in the feet than two under the ball of each great toe; and in the hands sometimes two very small ones at the middle joynt of each thumb; and sometimes one at the lower end of each thigh-bone at the beginning of the Plantaris muscle. Their use is the same with the Patella.

Tab. iv.  
D.

Tab. iv. E.

Tab. iv. F.

I FIND also in some bodies the little cartilages at the receiving ends of the bones of the fingers ossified; which surely those authors reckon among the Sesamoid bones, who say they are found to the number of forty-eight.

## C H A P. VI.

*Of the Cartilages.*

EVERY part of a bone which is articulated to another bone for a sliding motion, is covered or lined with a cartilage, as far as it moves upon, or is moved upon by another bone in any action; for cartilage being smother and softer than bone, it renders the motions more easy than they would have been, and prevents the bones wearing each other in their actions. These cartilages in the largest joynts are as thick as a shilling, and in the smallest as thin as paper.

IN the forepart of each articulation of the lower jaw, there is a loose cartilage upon which the

D 4      condyloid

## *Of the Cartilages.*

condyloid process moves on one side, while the jaw is moved to the other; and the two processes being thus raised at once, the jaw is thrust forward.

IN the joint of the knee are two loose, almost annular cartilages, which being thick at their outer edges, and thin at their inner ones, make the greatest parts of the two sockets in this joint. The use of these cartilages is to make variable sockets to suit the different parts of the lower end of the Os Femoris, for none but a round head and a round cavity can suit in motion, unless the shape of one or the other alters; and it is plainly necessary, that this lower end of the Os Femoris, should be flattish, and projected backward, to give advantage to the muscles that extend the Tibia, by setting the center of motion backward; which mechanism, though it equally lessens the power of those muscles which bend this joint, is yet of great service, because the extending muscles move this joint under the weight of the whole body, but the flexors only raise the legs; and as no head or socket moves so easily as round ones, here seems to be some provision made against the inconvenience of a flattish head and cavity, by having the friction made upon two surfaces, the Os Femoris upon the loose cartilages, and the loose cartilages upon the Tibia. This contrivance is always found necessary by mechanicks, where the friction of the joints of any of their machines is great, as between the parts of hook-hinges of heavy gates, and between the male and female



female screws of large vices, where they always place a loose ring.

THERE are other cartilages which serve to give shape to parts. Of this sort are the ciliary cartilages at the edges of the eye-lids, the cartilages of the outer ears, and those which compose the lower part of the nose, which have this particular advantage in these places, that they support and shape the parts as well as bones do, and without being liable to be broke.

THE ribs have cartilages of a considerable length, which articulate the seven uppermost, and sometimes eight on each side to the Sternum; which cartilages being very pliable, suffer the ribs to move easily in respiration, and the body to twist or bend to either side without difficulty. But the cartilages of the lower ribs do not reach the Sternum. And at the bottom of the Os Pectoris or Sternum, is a cartilage which is named from its commonest figure, *Ensiformis*. Tab.i. 20.

THERE are other cartilages which compose the Larynx and Aspera Arteria. The Larynx is formed of five: The foremost is like a saddle, but is named *Thyroides*; behind this are two called *Arytænoides*; they compose the *Rimula* of the Larynx. Over these is the *Epiglottis* to cover the *Rimula* while the aliment passes to the Pharynx; and under them one like a seal ring, named *Cricoides*. The cartilages which compose the Aspera Arteria, or remaining part of the wind-pipe, are not quite annular, but connected by membranes at their back-part, to give way to the aliment descending through the Pharynx. Tab.i. 21.

THERE

## *Of the Ligaments.*

THERE are other parts that authors call cartilages, which I rather chuse to rank with the ligaments: And therefore will describe them in that chapter, as those between the bodies of the *Vertebræ*, &c.

I HAVE several times found supernumerary cartilages from the Sternum, running between the ribs, and frequently the *Cartilago Ensiformis* double. I do not remember that I have ever seen a cartilage scale like a bone, or slough like softer parts, though I have often seen them eat through by matter that has been collected in a joynt, which  
 Tab.iv. E. has sometimes occasioned the bones to grow together.

## CHAP. VII.

### *Of the Ligaments.*

**E**VERY bone that is articulated to another for motion, is ty'd to that it moves upon, by a ligament, whose thickness and strength always bears a proportion to the quantity of motion in the joynt, and the force with which it is liable to be moved; and the length of the ligament is no more than sufficient to allow a proper quantity of motion.

THE bones of the limbs that move to all sides, have ligaments like purses, which arise from or near the edges of the sockets of the receiving bones,

bones, and are inserted all round the received bones, a little below their heads.

THE beginnings of these ligaments, from edges of these sockets of the Scapula and Os Innominatum are very hard, almost cartilaginous, which serves in the Scapula to make a larger socket, and such a one as will alter its figure as the bone moves, for the reason I have mentioned in the loose cartilages of the knee; for the head of the Os Humeri, not being an exact portion of a sphere, requires such a socket, and the hard part of this ligament of the socket of the Os Innominatum makes the socket deeper than the semidiameter of the socket, without any hindrance to motion, because it will give way to the neck of the Os Femoris, when it presses against it.

THE ligaments of those articulations which admit only of flexion, and extension, differ from the former in this only; that they are much shorter and stronger at the sides of the joynts, and thinner backward and forward.

At the upper part of the articulation of the Os Femoris and Os Innominatum, is a strong ligament of great consequence; it contributing very much to preserve that joynt from being luxated by the weight of the body. And from the lower edge of the Acetabulum of the Os Innominatum, runs a ligament to the middle of the head of the Os Femoris, about two inches long (which the Motion in this joynt requires) called Teres, or Rotundum, whose use is to prevent the Os Femoris from being luxated upwards, but downwards it will let it go far out of the socket; which  
fully

fully shews, that in men it is particularly contrived to prevent the thigh-bone from being dislocated upwards; but in brutes the head of the *Os Femoris* being oblong, and the cavity suitable, there can be only a rotatory motion, which in the effect will be very little more than that kind of motion which is called bending and extending; and this never removing the end of the head of the bone far in the socket, a short ligament is enough for it, and will better keep the bone in its place; and therefore it is that theirs is so short. This ligament in men may also serve to press the gland in the bottom of the *Acetabulum* or socket.

TOWARDS the great Foramen, of the *Ossa Innominata*, the *Acetabulum* has a deep notch, from one side of which to the other, runs a ligament, which I have seen ossified. Such a ligament there is also running from one process of the *Scapula* to the other, which hinders the *Os Humeri* from dislocating upward.

IN the middle and back part of the joynt of the knee are two very strong ligaments which arise from a process at the end of the *Tibia*. They cross each other in such a manner, as is best to secure the joynt from being displaced any way; they also hinder the extensors of the *Tibia* from pulling that bone too far forwards.

ALL the bones of the *Vertebræ*, and every joynt that is without motion, and not joined by a suture, as the *Ossa Innominata* with each other, and the *Os Sacrum* with the *Ossa Innominata*, are all



all joined by intervening ligaments, commonly called cartilages.

THE *Processus Dentatus* of the second Vertebra, is tied to the scull by a ligament, and kept close to the fore-part of the first Vertebra by another in that Vertebra, that it may not bruise the spinal marrow; and when either this ligament or process is broke, it makes that sort of broken neck which is attended with sudden death.

THE bones of the *Carpus* and *Tarsus* are tyed together by ligaments running promiscuously upon their surfaces from one to another, which at the under side of the *Tarsus* are vastly strong, because they support the whole body. There is also to the *Carpus*, a strong ligament which runs from the fifth bone to the eighth, and the process of the fourth bone: The proper use of this is, to bind down the tendons of the muscles that bend the fingers.

THE *Os Hyoides* to the *Processus Styloformis* of the *Os Petrosum*, the *Patella* to the *Tibia*, and the sesamoid bones in their places, are all tyed by ligaments.

FROM the edge of the *Ilium* to that of the *Os Pubis*, runs a ligament which is contiguous to, and appears to be a part of, the tendons of the oblique muscles of the *Abdomen*; its use is to cover the iliack vessels as they descend to the thigh: Under this ligament, together with the vessels, I have often met with a rupture of matter, and, I think, sometimes the gut, (however I dare affirm that to be a possible case) from the *Abdomen* into the anterior part of the thigh, immediately

## *Of the Ligaments.*

ately below the groin. Such cases are well worth the observation of surgeons; because opening such tumours may be of very bad consequence.

THE tendons of all the muscles that are not involved in fat, are either tyed down to the bones they pass over, by ligaments which contain a lubricating Mucus, or have sometimes communications with the joynt they move: As has been curiously observed by Dr. Douglass, particularly in the joynt of the hip. The use of these ligaments is to confine them to their proper directions, and contain the Mucus that lubricates their surfaces, to make their motions more easy.

FROM the Tibia to the Fibula, and from the Ulna to the Radius, are transverse ligaments which help to keep these bones together, and give origins to a great many muscles. There is another of this sort in the great Foramen of the Os Innominatum; and one between the Os Sacrum and processes of the Ossa Ischia; and some more in the body, too small to have a particular account given of them in this place.

AUTHORS agree that the ligaments are insensible; and give for their reason, that they would else be injured by ordinary motions. But they are much better contrived, seeing none of them, except those which lie between the bones, are subject to attrition; and those they have called cartilages. I do not think that these last are sensible; but the other I have had frequent experience are capable of very acute pains, there being not any thing our patients more grievously complain of, than collections of matter within these parts,

or

or sharp medicines applied to them when laid bare.

---

C H A P. VIII.

*Of the lubricating Glands of the Joints.*

EVERY joint where the bones are faced with a cartilage for a sliding motion, is furnished with small glands, which separate a mucilaginous matter for the lubricating of the ends of the bones, that they may move easily upon one another; and that there may be no waste of this necessary fluid, it is contained in the investing ligaments; which for this very reason are no where divided, except to communicate with the ligaments of tendons.

THESE glands are generally seated near the insertions of the ligaments, that they may be compressed by them when the joints are in motion; which is a proper time to have their fluid pressed out.

THERE is one large gland of this sort, seated in a Sinus at the bottom of the Acetabulum of the Os Innominatum, which is compressed by the Ligamentum Teres.

WHEN from violent bruises, or any other cause, these glands are ulcerated, they throw off a corrosive matter, which erodes the cartilages of the bones, 'till it insinuates it self into their spongy heads, and renders their whole substance cari-

*The Case of a fractured Skull.*

ous. When this disease happens to the hip, in time it makes its way through the ligament, and then it gets under the Gluteus Maximus to the outside of the thigh under the flat tendon of the Fascialis muscle, and sometimes to the forepart of the thigh, where the great blood-vessels run. In this case, which is very rare, I apprehend that the surrounding ligament is perforated before, as was mentioned in the last chapter. These cases are generally, if not always, incurable.

*A Case of a fractur'd skull, in a Girl nine years of age. Vide Tab. IX.*

**T**HIS girl being brought into the hospital the twenty seventh of May, seven days after the skull was fractured, having had all that time very bad symptoms; I immediately opened the scalp and let out about two ounces of grumous blood, and laid the skull bare about four inches one way, and three the other; and tied the blood vessels, that I might make the operation without much difficulty, the next morning. The fracture extended across the Os Bregmatis, from the sagittal suture, to the temporal bone; that part next the Os Frontis was depressed equal to its thickness, and a great deal of extravasated blood partly turned to matter, lay under the other part of the same bone. I made two perforations with the trephine, close to the fracture, that I might raise it up steadily through both, and have more room for the extravasated blood to discharge from under



der the scull; which had discharged before in great quantity through the fracture. But nevertheless ten days after the former operation, I was obliged to make another perforation, to discharge the matter more freely; for during a month, the matter ran through all her dressings down her face, twice every day, and was exceedingly foetid; and for the space of five months the matter decreased very little in quantity, but grew less and less offensive, till September the thirteenth, when the least of the bones was taken out; and on Sep-  
tember the twenty ninth, the large one; after  
which time the matter was good, and not too  
much in quantity. Both these bones are through  
both Tables, for the motion in the brain was  
seen, only some little parts of the lesser bone remaining, a callous was formed from them, but where the great one came away there was none, only a common cicatrix; and besides these, there were many little bits of bone came away in the dressings: She was soon after cured, and has remained well ever since.

Tab. ix.

Tab. ix.

D.

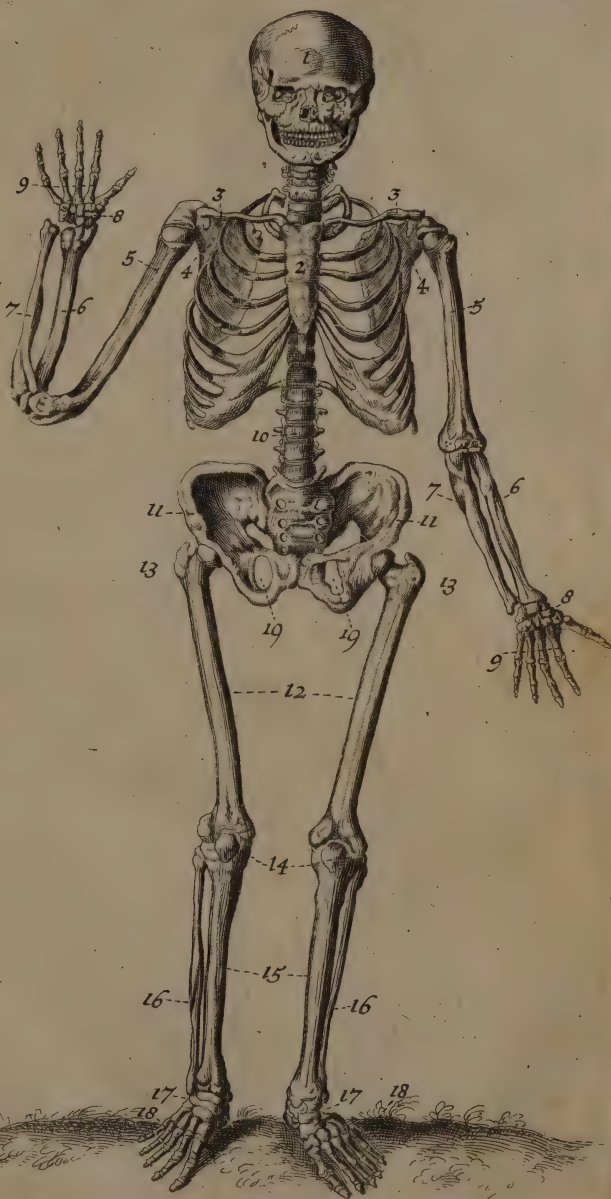


## TABLE I.

*The fore view of a skeleton.*

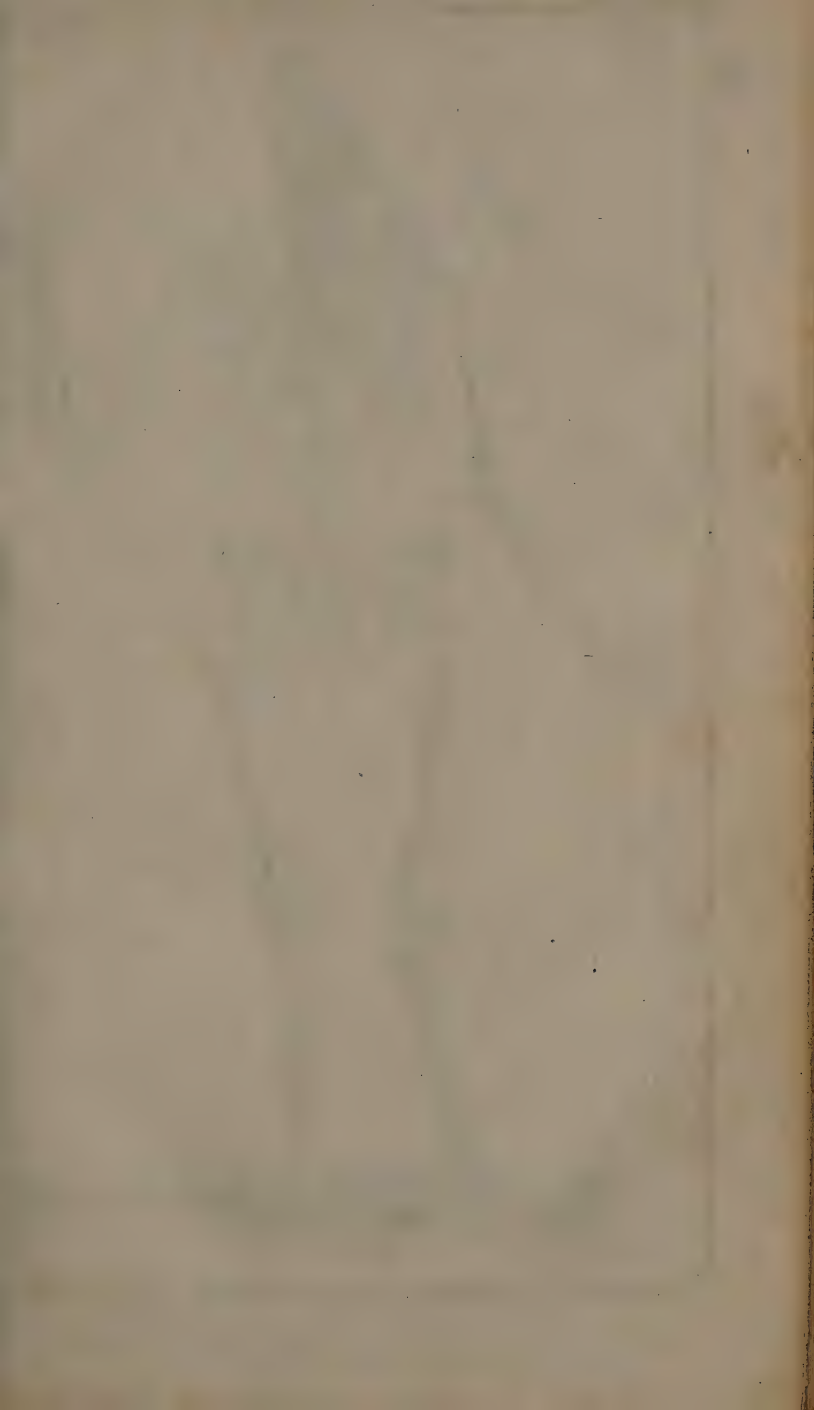
- 1 Os Frontis.
- 2 Offa Pectoris.
- 3 Clavicula.
- 4 Scapula.
- 5 Os Humeri.
- 6 Radius.
- 7 Ulna.
- 8 Carpus.
- 9 Metacarpus.
- 10 Spina Dorfi.
- 11 Os Innominatum.
- 12 Os Femoris.
- 13 Trochanter Major.
- 14 Patella.
- 15 Tibia.
- 16 Fibula.
- 17 Tarsus.
- 18 Metatarsus.

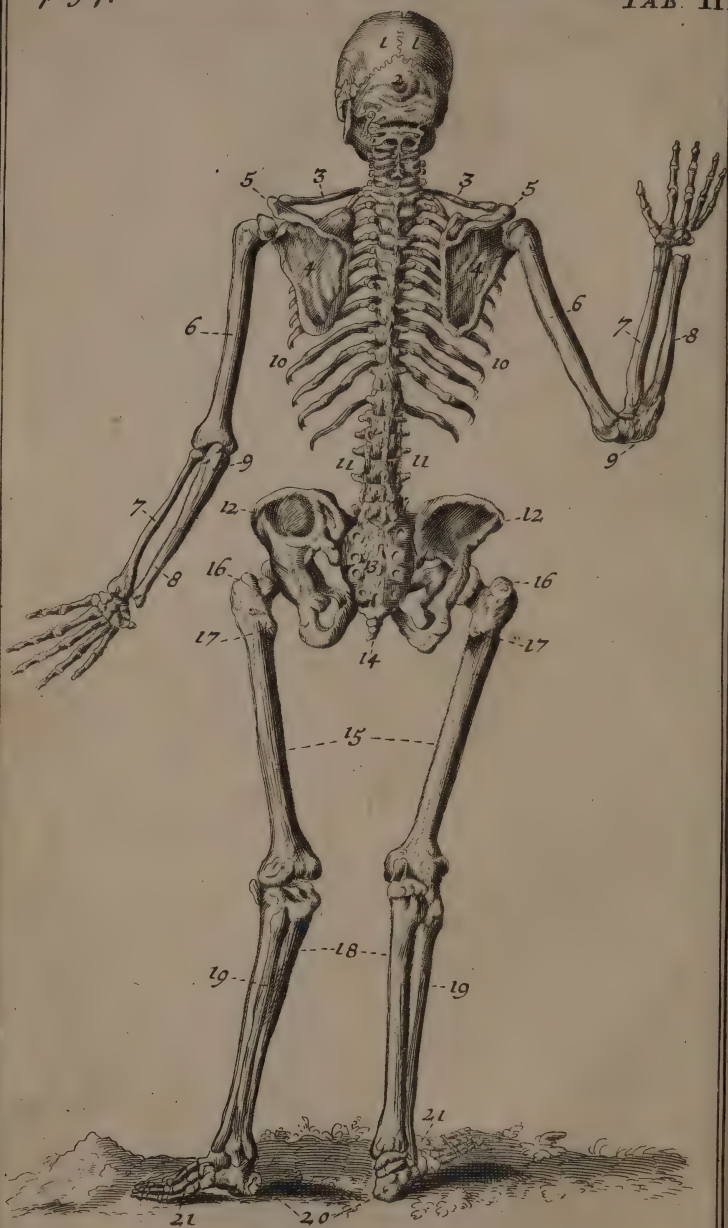
TABLE











## T A B L E II.

*The back view of a skeleton.*

- 1 Os Bregmatis.
- 2 Os Occipitis.
- 3 Clavicula.
- 4 Scapula.
- 5 Processus Acromion.
- 6 Os Humeri.
- 7 Radius.
- 8 Ulna.
- 9 Olecranon.
- 10 Costæ.
- 11 Spina.
- 12 Os Innominatum.
- 13 Os Sacrum.
- 14 Os Coccygis.
- 15 Os Femoris.
- 16 Trochanter Major.
- 17 Trochanter Minor.
- 18 Tibia.
- 19 Fibula.

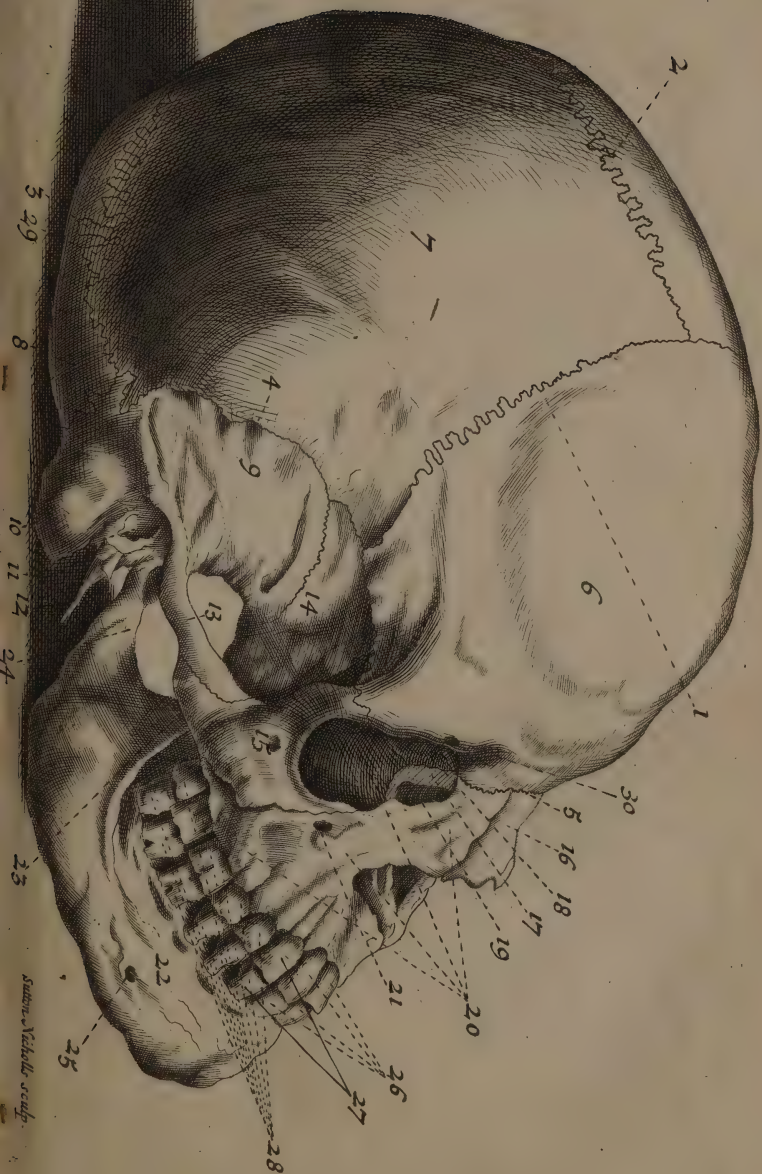
## T A B L E III.

*The bones of the head.*

- 1 Sutura Coronalis.
- 2 Sutura Sagittalis.
- 3 Sutura Lambdoidalis.
- 4 Sutura Squamosa.
- 5 Sutura Transversalis.
- 6 Os Frontis.
- 7 Os Bregmatis.
- 8 Os Occipitis.
- 9 Os Temporis.
- 10 Processus Mamillaris.
- 11 Meatus Auditorius.
- 12 Processus Styliformis.
- 13 Processus Jugalis.
- 14 Os Sphenoides.
- 15 Os Malæ.
- 16 Os Nasi.
- 17 Os Unguis.
- 18 Os Planum.
- 19 Ductus ad Nasum.
- 20 Maxilla superior.
- 21 Foramen Maxillæ superioris.
- 22 Maxilla inferior.
- 23 Processus Coronalis.
- 24 Processus Condylodes.
- 25 Foramen.
- 26 Dentes Incisorii.
- 27 Dentes Canini.
- 28 Dentes Molares.

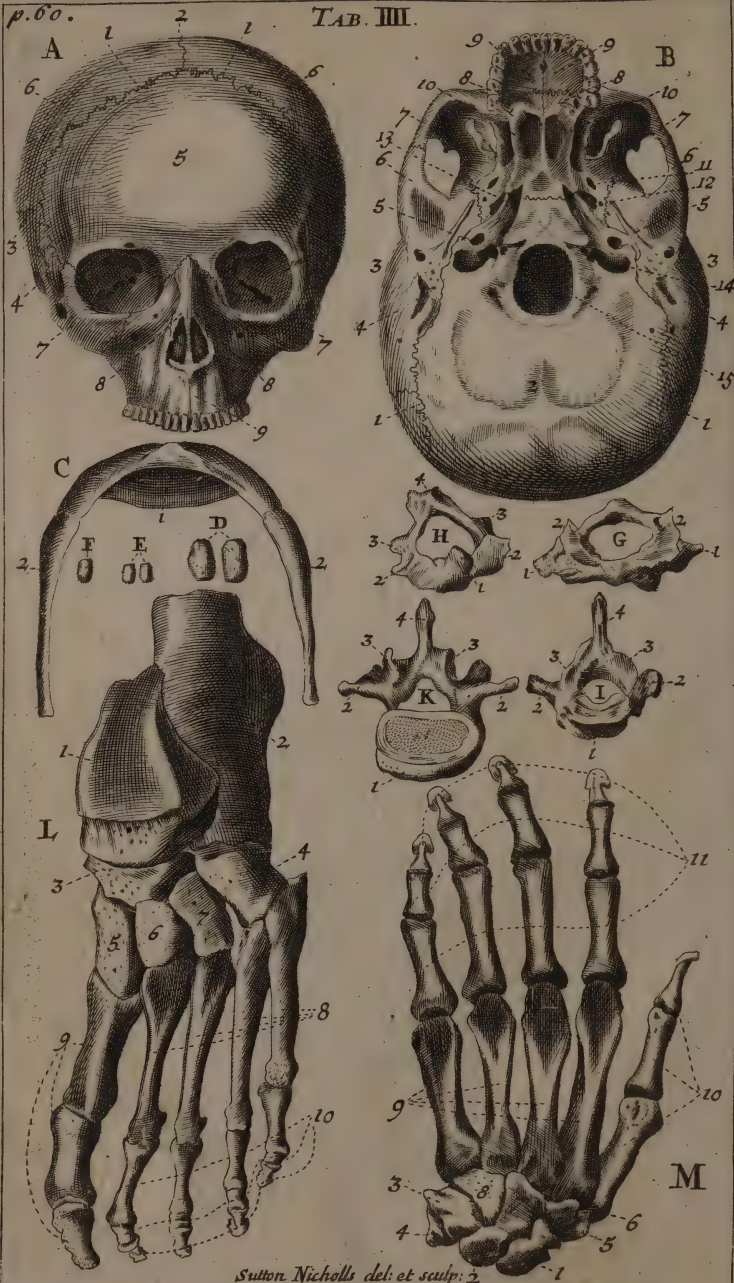
T A B L E













## TABLE IV.

A, *The fore view of the skull.*

- 1 Sutura Coronalis.
- 2 Sutura Sagittalis.
- 3 Sutura Squamosa.
- 4 Sutura Sphenoidalis.
- 5 Os Frontis.
- 6 Os Bregmatis.
- 7 Os Malæ.
- 8 Os Nasi.
- 9 Maxilla superior.

## B, A View of the Basis of the skull.

- 1 Sutura Lambdoidalis.
- 2 Os Occipitis.
- 3 Os Temporis.
- 4 Processus Mamillaris.
- 5 Processus Styloides.
- 6 Processus Jugalis.
- 7 Os Malæ.
- 8 Os Palati.
- 9 Maxilla superior.
- 10 Processus Pterygoides.

## C, The Os Hyoides.

1. Basis.
2. Cornua.

D, The Offa Sefamoidea of the great toe.

E, The Offa Sefamoidea of the thumb.

F, The sesamoid bone that is sometimes found near the beginning of the Plantaris muscle.

G, The first Vertebra.

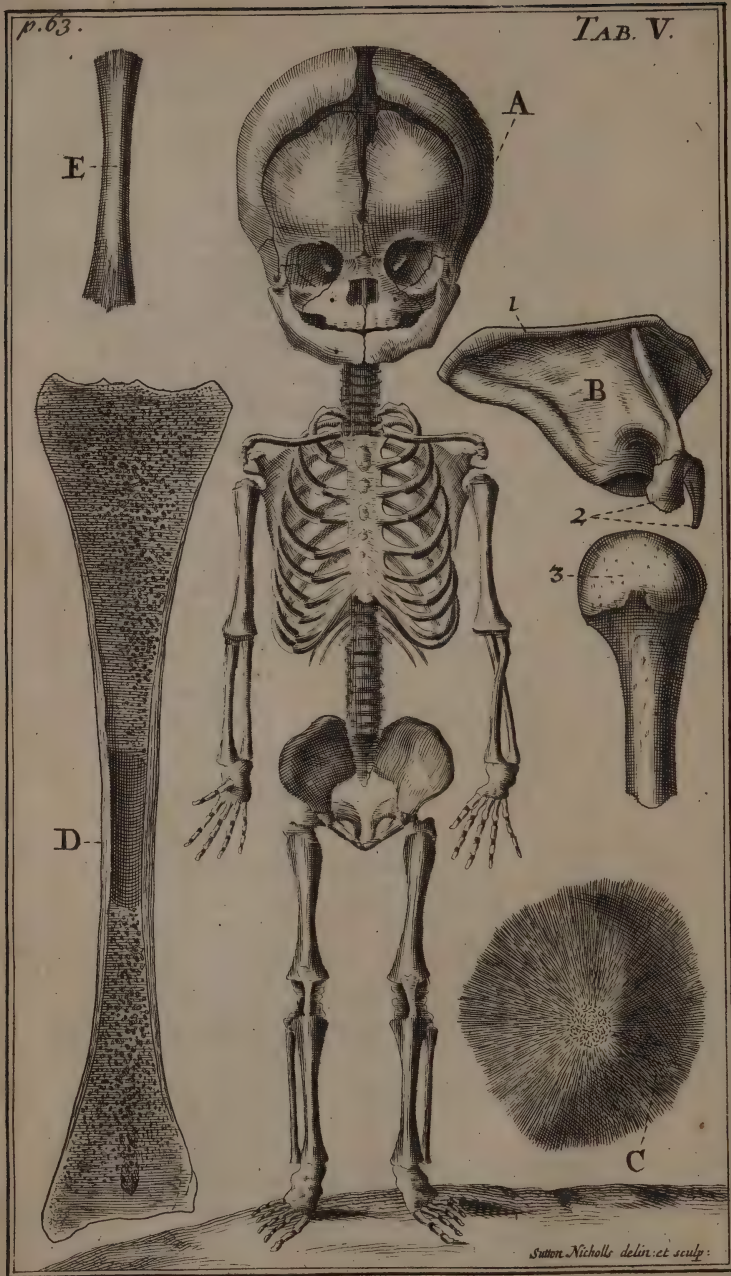
- 1 Processus Transversus.

E 3

2 Pro-

- 2 Processus Obliquus.
- H, The second Vertebra.
  - 1 Processus Dentatus.
  - 2 Processus Transversus.
  - 3 Processus Obliquus.
  - 4 Processus Spinalis.
- I, One of the Vertebrae of the Thorax.
  - 1 Corpus Spongiosum.
  - 2 Processus Transversus.
  - 3 Processus Obliquus.
  - 4 Processus Spinalis.
- K, One of the Vertebrae of the loins.
  - 1 Corpus Spongiosum.
  - 2. Processus Transversus.
  - 3 Processus Obliquus.
  - 4 Processus Spinalis.
- L. The bones of the Foot.
  - 1 Astragalus.
  - 2 Os Calcis.
  - 3 Os Naviculare.
  - 4 Os Cuboides.
  - 5 Os Cuneiforme majus.
  - 6 Os Cuneiforme medium.
  - 7. Os Cuneiforme minimum.
  - 8 Metatarsus.
  - Offa Pollicis Pedis.
  - 10 Offa Digitorum Pedis.
- M, The bones of the hand.
  - 1, 2, 3, 4, } The eight bones of the Carpus,
  - 5, 6, 7, 8. }
  - 9 Metacarpus.
  - 10 The bones of the thumb.
  - 11 The bones of the fingers.







## T A B L E V.

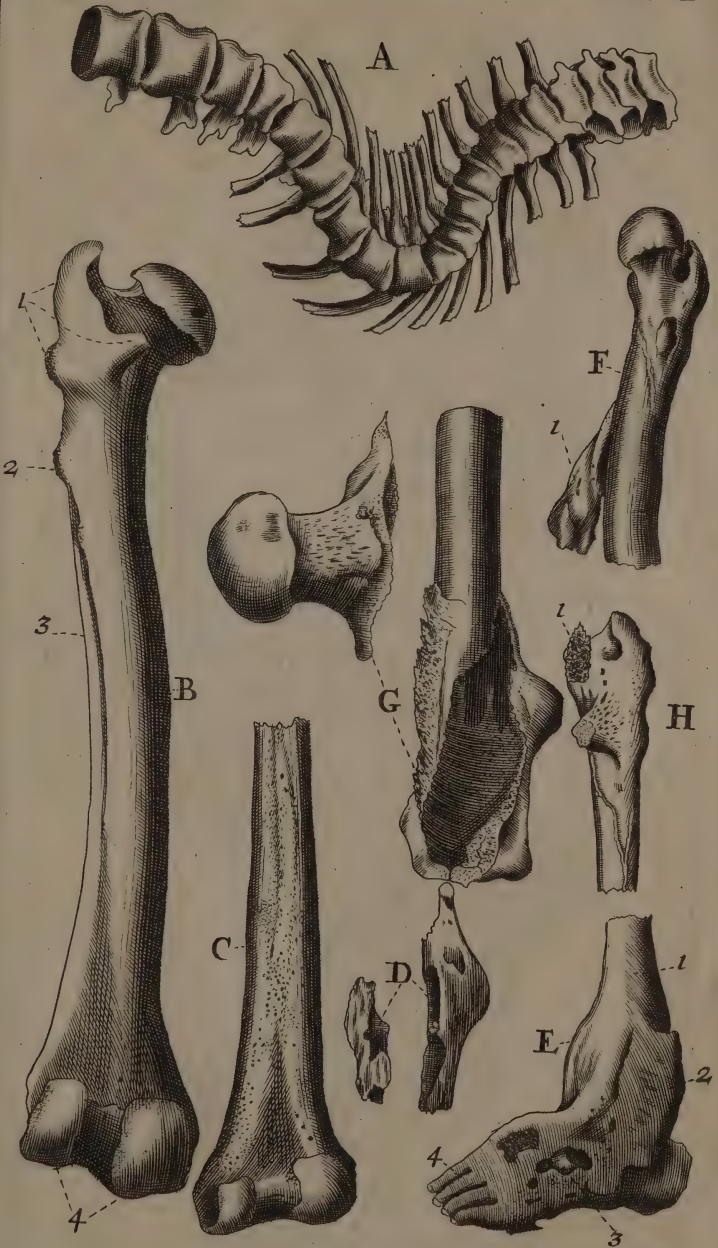
- A, S H E W S the ſkeleton of a full grown Fœtus, in which may be obſerved, the Epiphyſes, the Carpus and Tarſus, which are cartilaginous ſhrunk in drying, and the ſhape in general differing from the ſkeleton of an adult.
- B, The Scapula of a body twelve years old.
- 1 An Epiphyſis at the Baſis.
  - 2 The Epiphyſes of its Proceſſes.
  - 3 The Epiphyſis at the upper end of the Os Humeri from the ſame body.
- C, The Bregma of a Fœtus five months old prepared, to ſhew the fibres oſſifying from a middle point, and ſhooting out on every ſide.
- D, The Tibia ſawed length-ways.
- E, The Tibia of a Fœtus five months old with the Epiphyſes off.

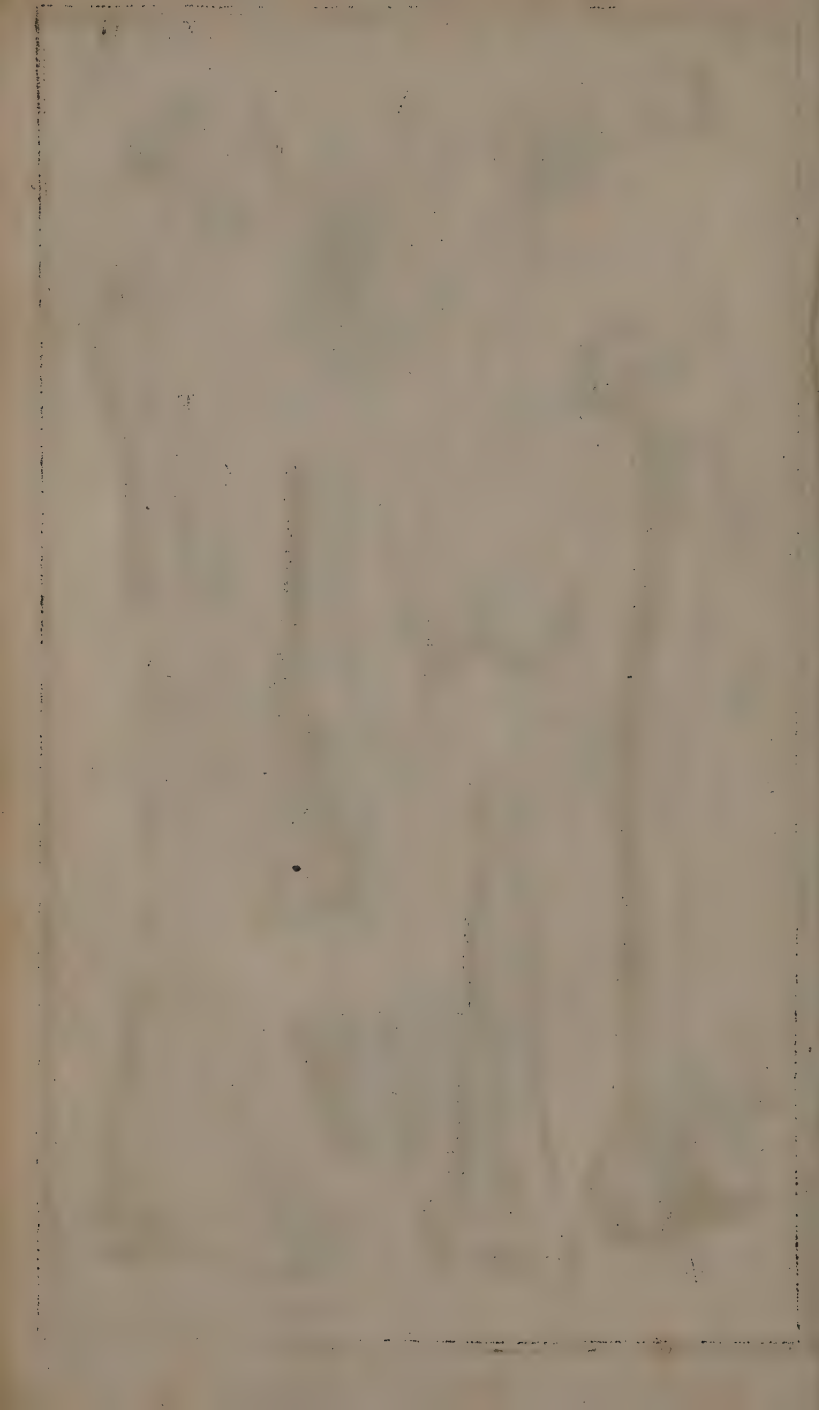


## T A B L E VI.

- A, A distorted spine.
- B, The Os Femoris of a man eight foot high.  
 1 Shows three Trochanters.  
 2 A fourth Trochanter.  
 3 The Linea Aspera.  
 4 The two inferior Apophyses.
- C, Part of an Os Femoris carious.
- D, Half the lower jaw exfoliated.
- E, Part of a carious leg and foot, with all the bones grown into one.  
 1 The Tibia.  
 2 The Fibula.
- F, Part of a thigh-bone.  
 1 A bony excrescence.
- G, The head of the Os Femoris broken off, which had been mistaken for a luxation.
- H, Another piece of an Os Femoris with the head broke off; which was also mistaken for a luxation.

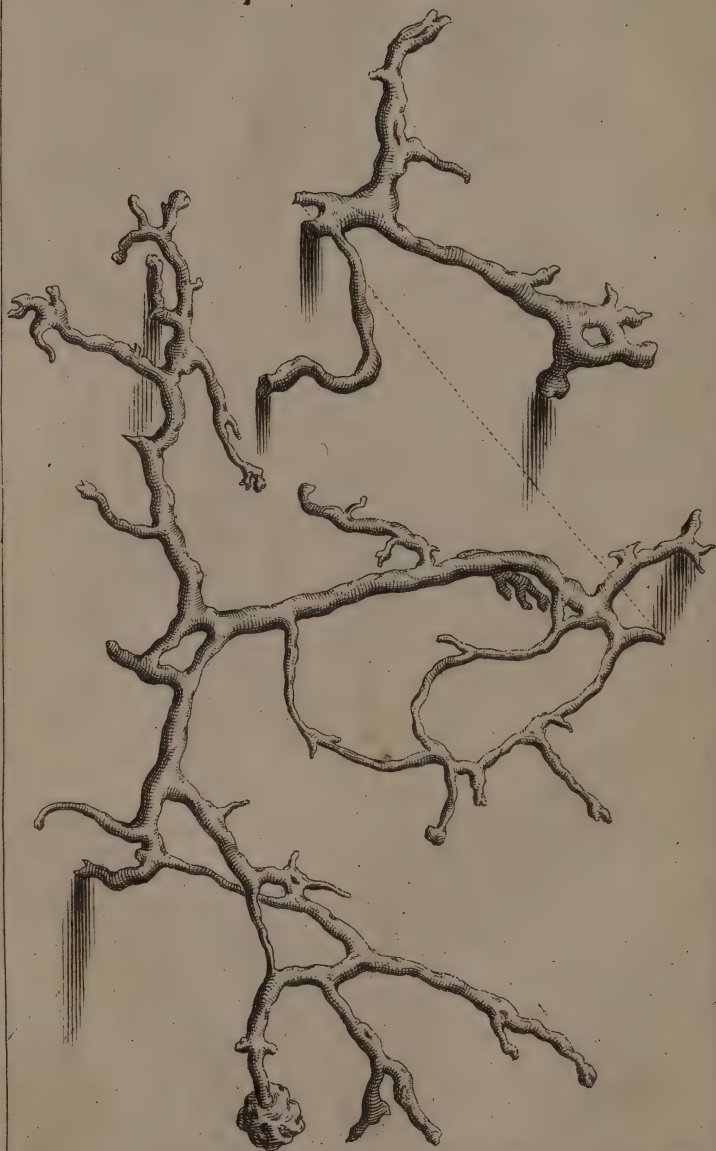












## TABLE VII.

A BONE from the Omentum of a sheep taken out and delineated by Dr. Steukly. The pricked Line shews the places where the bones were united.



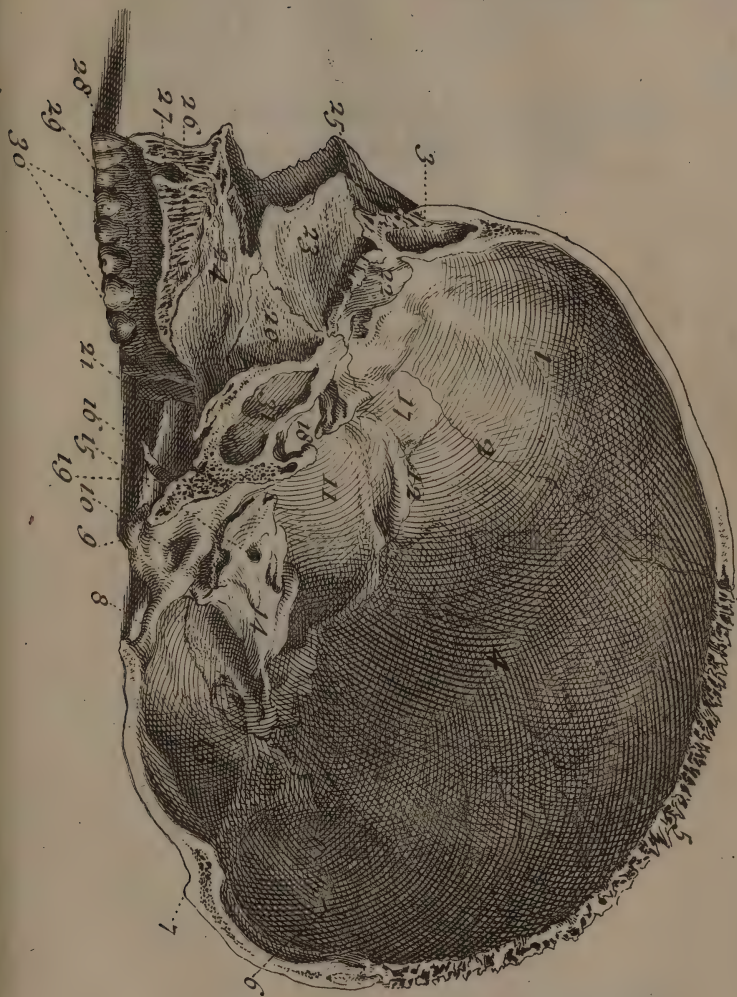
TABLE

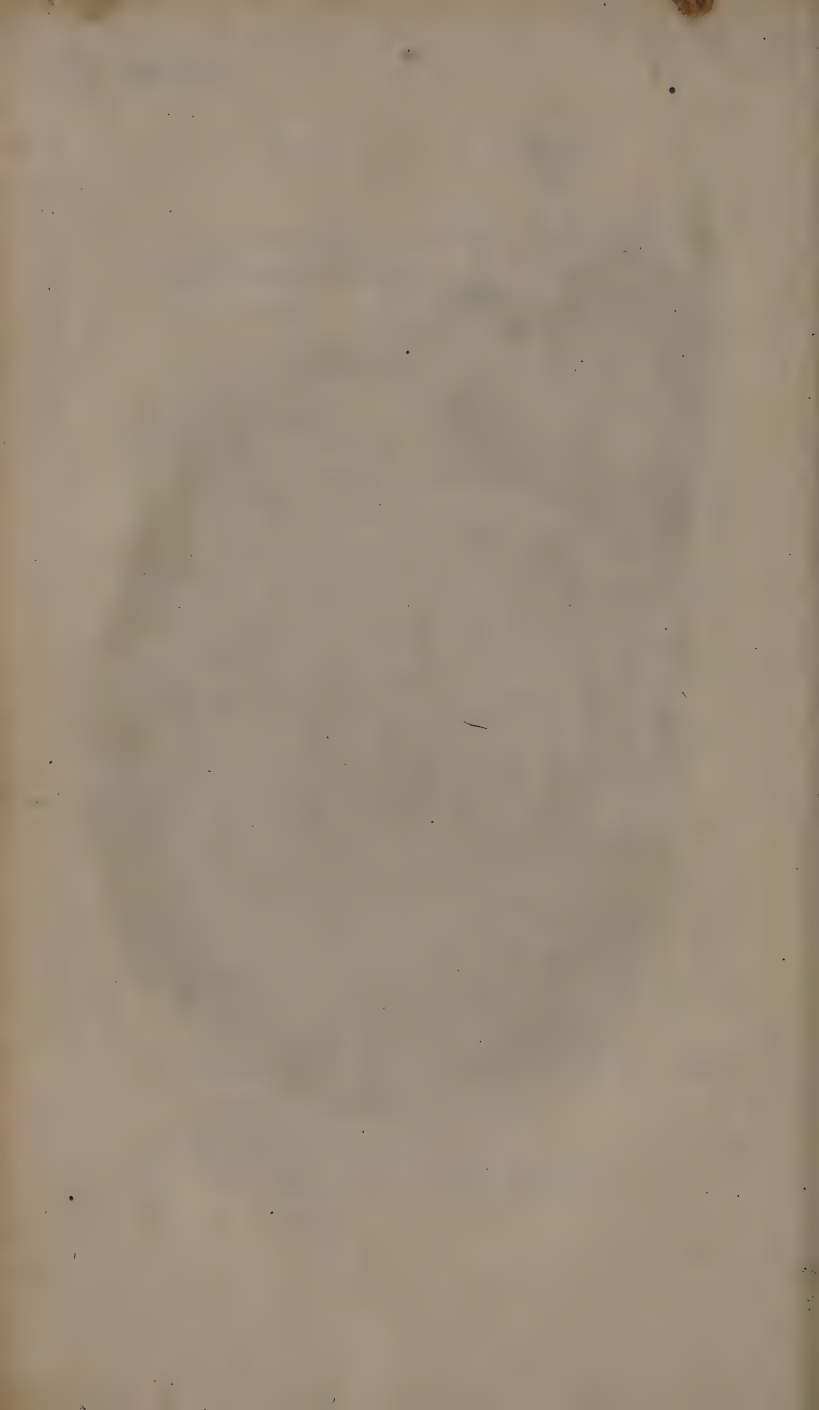
## T A B L E VIII.

REPRESENTS the inside of the scull saw'd through longitudinally.

- 1 Os Frontis.
- 2 Sutura Coronalis.
- 3 Sinus Frontalis.
- 4 Os Bregmatis.
- 5 Sutura Sagittalis.
- 6 One of the Offa Triquetra.
- 7 A process of the Os Occipitis.
- 8 Part of the Foramen Maximum.
- 9 The process of the occipital bone that articulates it to the spine.
- 10 The ninth Foramen of the scull.
- 11 Os Temporis.
- 12 Sutura squamosa.
- 13 Os Occipitis.
- 14 Os Petrosum.
- 15 A Foramen, through which passes the auditory nerve.
- 16 Processus Styloformis.
- 17 Os Sphenoides.
- 18 Sella Turcica.
- 19 The Suture between the Os Occipitale and Sphenoidale.
- 20 A process of the Os Sphenoidale that makes part of the Septum Nasi.
- 21 Processus Pterygoides.
- 22 Crista Galli of the Os Ethmoides.







- 23 A process of the Os Ethmoides making part  
of the Septum Nasi.
- 24 Os Vomer.
- 25 Os Nasi.
- 26 The Suture that divides the Maxilla Superior.
- 27 A perforation in the Maxilla Superior.
- 28 Dentes Incisorii.
- 29 Dens Caninus.
- 30 Dentes Molares.
- 31 Sinus Sphenoidalis.



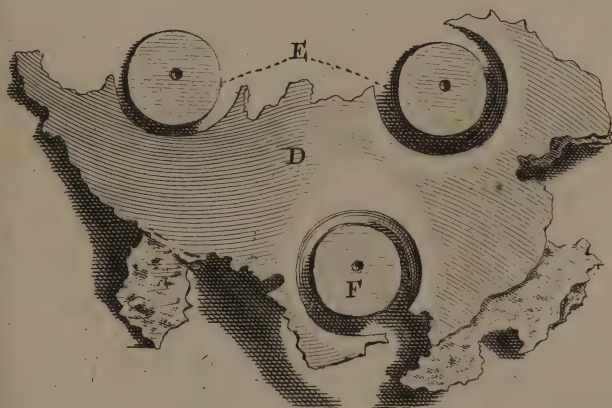
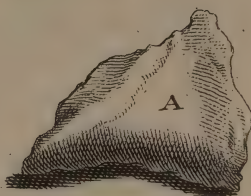
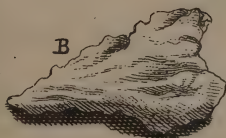
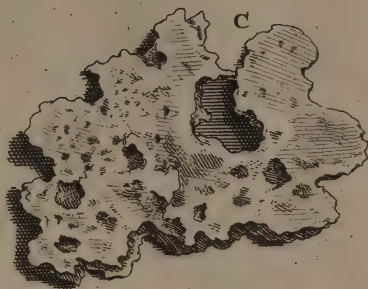
TABLE

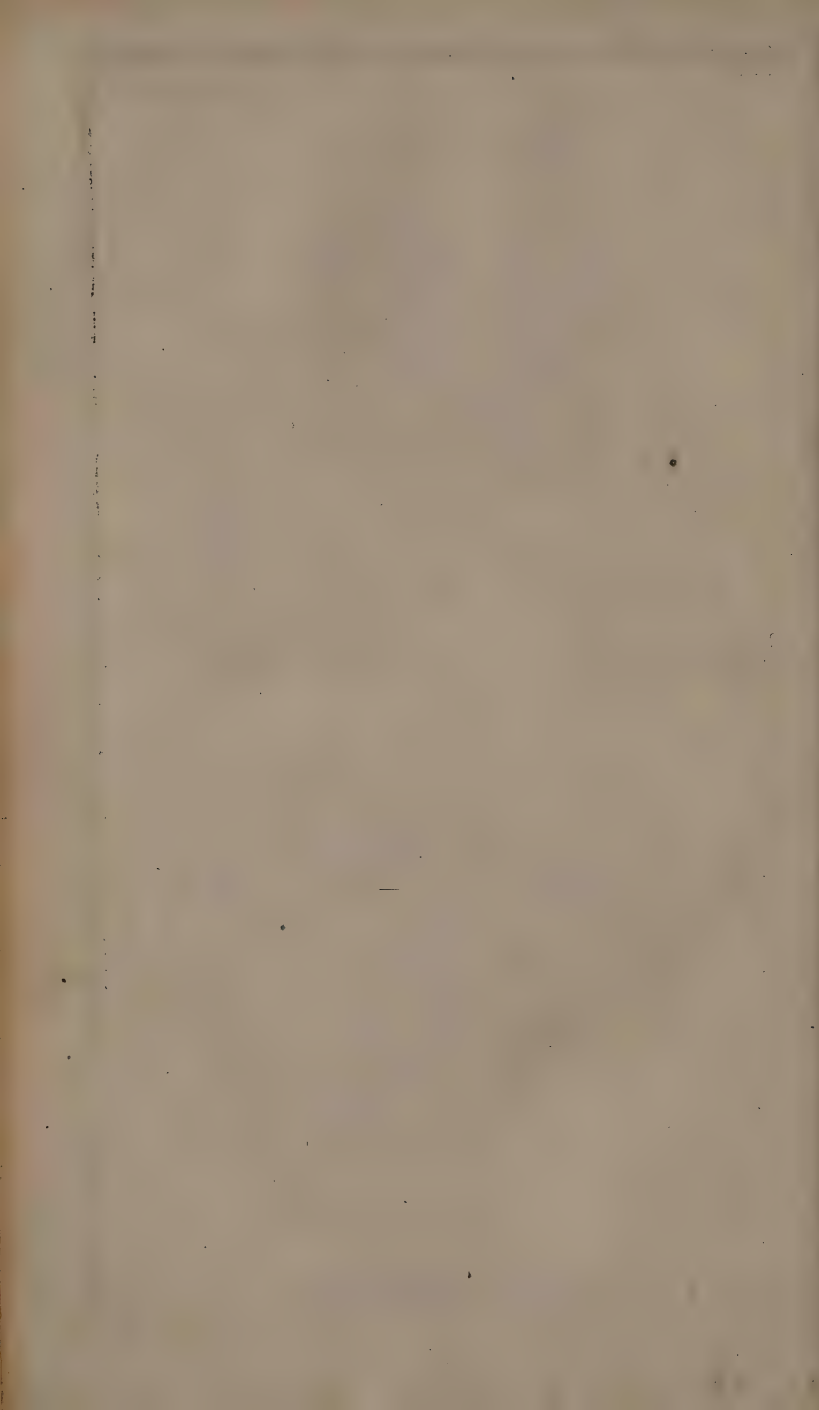
## T A B L E IX.

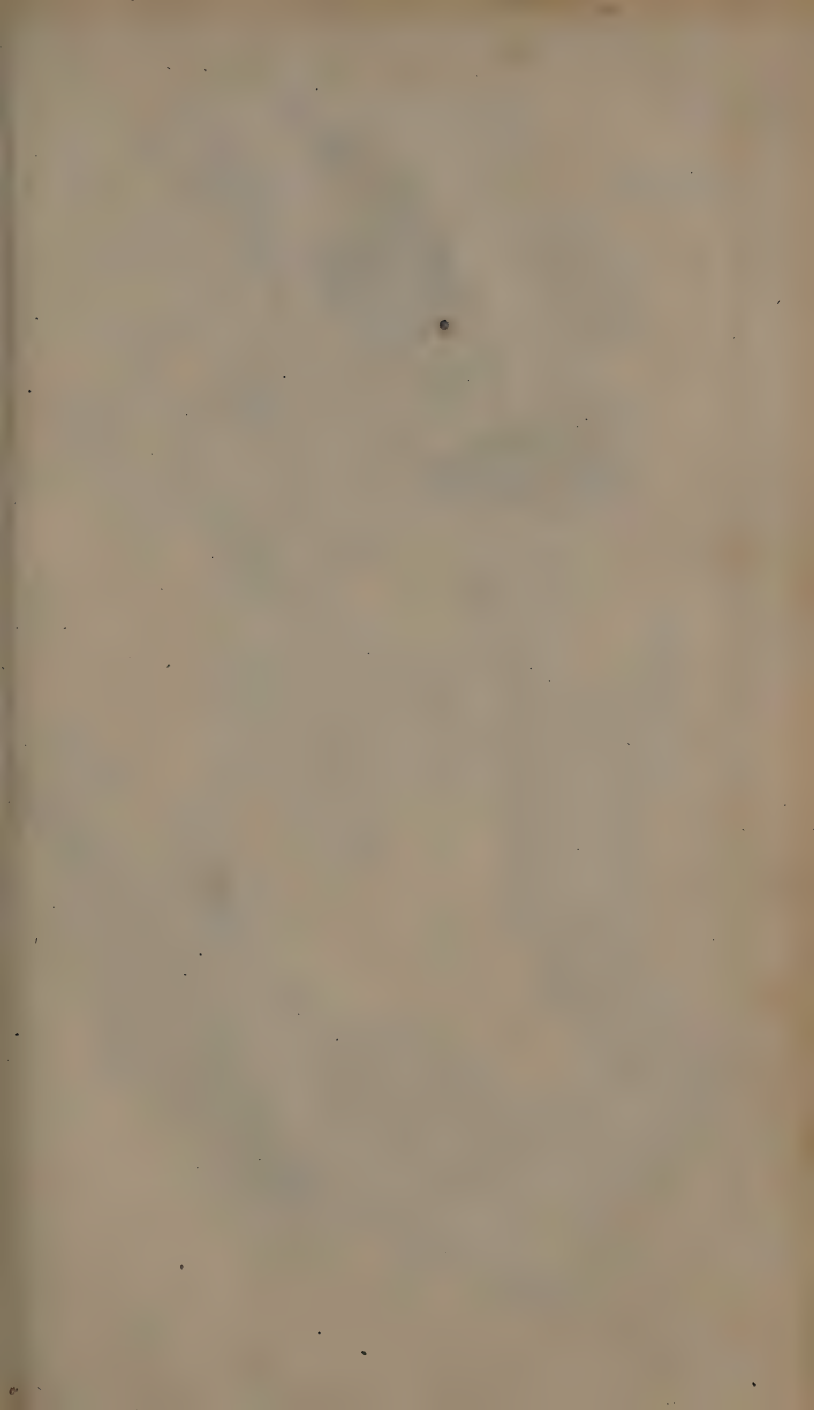
- A, A BONE taken out of the muscular part of the heart of a man. Vide page 7.
- B, A bone taken out of the first process of the Dura Mater not far from the Crista Galli.
- C, D, The two bones mentioned, page 54.
- C, Shews the under side of that part of the Os Bregmatis that was depressed.
- D, The piece of bone that separated last, and which was not depressed.
- E, The two places first trephined.
- F, The place last trephined to give more vent to the matter.















## TABLE X.

THE upper and lower jaw, being a specimen of an Osteology in folio, in which every bone will be done as large as the life.



BOOK





# BOOK II.

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## CHAP. I.

### *Introduction to the Muscles.*

**T**HE muscles are moving powers, applied to perform the several motions of the body; which they do by contracting their length, and thereby bringing the parts to which they are fixed nearer together. The immovable or least moved part any muscle is fixed to, is usually called its origin, and the other its insertion; but muscles that have their two ends equally liable to be moved, may have either called their origins or insertions.

EACH muscle is made up of a number of small fibres which Borelli and others have thought to be strings of bladders, and have endeavoured to account for muscular motion by an expansion made from an influx of blood and animal spirits into these bladders; but as the muscles do not increase their bulk sensibly in contracting, there  
needs

needs no more to be said to refute this hypothesis. (See Dr. Pemberton's introduction to Cowper on the muscles.) But Dr. Keil thought that in this way the muscles might be contracted by a swelling, scarce sensible, if the bladders are but very small: For, says he, supposing a bladder of any determined bigness can raise a weight a foot, a hundred bladders whose diameters are each a hundredth part of the former will raise the weight to the same height; but the force of inflation and the swelling of all together will be ten thousand times less, and it will also raise ten thousand times less weight, which he has not observed; therefore not one such string of bladders, but ten thousand must be applied to do the same thing that the one bladder will do: and they will have the same swelling, otherwise it would be easy to shew how to make a Perpetuum Mobile of prodigious force. For the Discovery of this mistake in Dr. Keil, I am obliged to Dr. Oldfield.

THE muscles are of two sorts, viz. rectilineal and penniform. The former have their fibres almost parallel in the same or near the same direction, with the Axis of the muscle; and the latter have their fibres joined in an oblique direction, to a tendon passing in or near the Axis, or on their outside.

THE rectilineal muscles, if their origins and insertions are in little compass, are never of any considerable thickness, unless they are very long, because the outward fibres would compress the inner ones, and make them almost useless; and therefore every rectilineal Muscle whose inner fi-  
bres

bres are compressed by the outer, have their inner fibres longer than the external, that they may be capable of equal quantity of contraction.

THE Penniform muscles, though they are in a manner free from the inconvenience of one fibre compressing another, and though by the obliquity of their fibres, nothing is abated of their moment, as is clearly demonstrated by an Experiment of Mr. Hawksbee's, where it is shewn, that in all cases, just so much more weight as rectilinear fibres will raise than oblique ones, the oblique will move their weight with just so much greater velocity than the rectilinear; which is making their moments equal: So that in the structure of an animal, like all mechanic engines, whatever is gained in strength is lost in velocity, and whatever is gained in velocity is lost in strength. Yet the fibres of the penniform muscles becoming more and more oblique as they contract, their strength decreases, and their velocity increases; which makes them less uniform in their actions than the rectilinear muscles; wherefore it seems that nature never uses a penniform muscle where a rectilinear muscle can be used; and the cases in which a rectilinear muscle cannot be used, are where the shape of a muscle is such as that the inward fibres would be too much compressed, or where rectilinear fibres could not have a lever to act with, suitable to their quantity of contraction, which is the case of all the long muscles of the fingers and toes; for every muscle must be inserted or pass over the centre of motion of the joint it moves, at a distance proportionable to

Tab. xii.



its quantity of contraction, and the quantity of motion in the joynt moved; for if it was inserted too near, then the motion of the joynt would be performed before the muscle is contracted all that it can; if too far off, the muscle will have done contracting before the whole motion of the joynt is made; and tho' the quickness and quantity of motion in a muscle will be, *Cæteris Paribus*, as the length of its fibres; for if a fibre four inches long will contract one inch in a given time, a fibre eight inches long will contract two inches in the same time; and the strength of a muscle or power to raise a weight, *Cæteris Paribus*, will be as the number of its fibres; for if one fibre will raise a grain weight, twenty fibres will raise twenty grains. Nevertheless, two muscles of equal magnitude, one long, and the other short, will both move the same weight with the same velocity when applied to a bone; because the levers they act with must be as their lengths, and therefore the penniform and short thick muscles are never applied to a bone for the sake of strength, nor long fibred muscles for quickness; for whatever is gained by the form of the muscle, whether strength or quickness, must be lost by their insertions into the bone, or else the muscles must not act all they can, or the bones have less motion than they are fitted for.

IN the limbs several muscles pass over two joynts, both of which they are liable to move at once, with force proportionable to the levers they act with upon each joynt; but either joynt being fixed by an antagonist muscle, the whole force of  
such

Such muscles will be exerted upon the other joynt; which in that case may be moved with a velocity equal to what is in both joynts, when these muscles act upon both at once. This mechanism is of great use in the limbs, as I shall shew in the proper places.

THAT only we call the proper use and action of any muscle which it has without the necessary assistance of any other muscle, and what that is in a muscle moving a joynt we may always know, and with what force it acts, *Cæteris Paribus*, by dropping a line from the center of motion of the joynt, it moves perpendicular into the Axis of the muscle in any situation; but in a joynt which admits only of flexion and extension, this line must also be perpendicular to the Axis of motion in that joynt, and the action of the muscles will be in the direction of that perpendicular line, and the force with which it acts in any situation will be, *Cæteris Paribus*, as the length of that perpendicular line.

EACH muscle, so far as it is distinct and is moved against any part, is covered with a smooth membrane to make the friction easy; but where they are externally tendinous those tendons are often smooth enough to make such a covering needless. Besides this membrane there is another, known by the name of *Fascia Tendinosa*, which deserves to be particularly considered. The strong one on the outside of the thigh, which belongs to the *Fascialis* and *Gluteus* muscles is of great use in raising the *Gluteus* farther from the centre of motion of the joynt it moves, to in-

crease its force: in like manner the Fascia detached from the tendon of the Biceps Cubiti alters its direction for the same purpose, but those on the outside of the Tibia and Cubit, &c. are only flat tendons from which the fibres of the muscles arise as from the bones. There are also in many places such tendons between the muscles, from which each muscle arises in like manner; for the bones themselves are not sufficient to give origin to half the fibres of the muscles that belong to them; besides, if all the fibres had rise from the bones they must have been liable to compress one another very inconveniently.

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## CHAP. II.

*Of the Muscles.*

Muscles  
of the Ab-  
domen.  
Tab. xii. 9.

**O**BLIQUUS DESCENDENS, arises fleshy from near the extremities of the eight inferior ribs, the upper part of its Origin being indented with the Serratus Major Anticus, and the lower laying under a small portion of the Latissimus Dorsi. It is inserted fleshy into the upper part of the spine of the Ilium, and by a broad flat tendon (which firmly adheres to a like tendon of the following muscle as they pass over the Rectus) into the Os Pubis, and Linea Alba, which is a strong tendinous line extended from the Os Pubis to the Sternum, between the Musculi Recti.

OBLI-

**OBLIQUUS ASCENDENS**, arises fleshy under the former muscle from the spine of the Ilium, and is inserted fleshy in the cartilages of the three lowest ribs, and by a flat tendon into the Sternum, and Linea Alba, together with the tendon of the foregoing muscle. The line in which these two tendons join on the outside of the Rectus muscle, is called Semilunaris: And though so much of this muscle as is inserted fleshy runs obliquely upward, yet the middle and lower part is directed transverse and downward; and beside the tendon which it unites with the Obliquus Descendens, it often detaches another near the Sternum to be inserted with the Transversalis under the Rectus.

**PYRAMIDALIS**, arises from the Os Pubis, and is inserted into the Linea Alba about three or four inches below the navel: This and its fellow are often wanting. Tab. xii.  
II.

**RECTUS**, arises tendinous from the Os Pubis, but fleshy when the Pyramidales are wanting, and is inserted into the lower part of the Sternum near the Cartilago Ensiformis. This muscle is divided into four or five portions by transverse tendinous intersections, that it might conveniently bend when the body is bowed forwards, though this muscle should be then in action; and these intersections are chiefly above the navel, where it is most liable to be bent: Besides being thus divided, its chief pressure will not be in its middle, but under the several bellies of the muscle, and the greatest below the navel, where is the longest fleshy belly of this muscle, Tab. xii.  
IO.



and where the parts in the Abdomen seem to want most to be supported.

**TRANSVERSALIS**, arises by a flat tendon from the transverse processes of the lumbal Vertebrae, and fleshy from the inside of the ribs below the Diaphragm, and from the spine of the Ilium, then becoming a flat tendon, it passes under the Rectus to its insertion into the Linea Alba. Between this tendon and the Peritoneum, sometimes water is found in great quantities, which distemper is called the dropsy in the duplicature of the Peritoneum, which shews this membrane has been mistook for part of the Peritoneum.

**THESE** five pair of muscles all conspire to compress the parts contained in the Abdomen. The Obliquus Descendens on the right side, and Ascendens on the left acting together, turn the upper part of the trunk of the body towards the left, & Vice Versa; but the trunk is chiefly turned upon the thighs; the Recti bend the body forward, and pull the Sternum downward in expiration; the two oblique muscles and the transverse on each side near the groins, are perforated to let through the Processus Vaginalis with the spermatick vessels. These perforations are distant from each other, so as to suffer the vessels to descend conveniently into the Scrotum; this way the intestines or the Omentum, descend in ruptures.

Muscles  
of the  
Testes.

**CREMASTER TESTIS**, is a small portion of fibres which arises from the Ilium, and appears to be part of the Obliquus Ascendens muscle, till it meets with the spermatick vessels at their coming

out



out of the Abdomen, where it begins to descend with them by the side of the Proceffus Vaginalis, to the testicle, over which it is loosely expanded. This muscle is too small to be plainly discovered in emaciated bodies.

**ERECTOR PENIS**, arises from the Os Ischi-  
um, and is inserted into the Crus Penis near the Os Pubis. It is said, by pressing the Penis against the Os Pubis, to compress the Vena Ipsius Penis, and hinder the reflux of blood, whereby the Penis becomes extended and erect; but it does not appear to me to be well contrived for that use. Muscles of the Penis.

**ACCELERATOR URINÆ**: This, with its fellow, are but one muscle; it arises tendinous from the Ossa Ischia, and fleshy from the Sphincter Ani, or, according to Mr. Cowper, from the superior part of the Urethra as it passes under the Os Pubis; and thence being expanded over the bulb of the Urethra, it afterwards divides, and is inserted into the Penis. The use of this muscle is not to accelerate the urine, for that is propell'd by the Detrusor Urinæ, or muscular coat of the bladder, but to protrude the Semen, which is done only by this; and it being seated opposite to the Os Pubis, it seems to be much better fitted to be a relaxer of the Penis by pulling it from the Os Pubis, than the Erector is for the office assigned it.

**TRANSVERSALIS PENIS**, is that part of the former muscle which arises from the Ossa Ischia.

**SPHINCTER VESICÆ URINARIÆ**, is a small portion of muscular fibres, not easily to be  
Muscles of the bladder

distinguished, running round the neck of the bladder to prevent the involuntary effusion of urine.

**DETRUSOR URINÆ**, is the muscular coat of the bladder; its fibres are differently disposed; but chiefly terminating in the Sphincter Vescicæ, whereby it not only presses the urine forward, but when the bladder is full, becomes an antagonist to the Sphincter, acting almost at right angles.

Muscles  
of Clito-  
ris.

**ERECTOR CLITORIDIS**, arises from the Ischium, and is inserted into the Crus Clitoridis, like the Erector Penis in men, and is said, to cause erection in the same manner.

Muscles  
of the  
Vagina.

**SPHINCTER VAGINÆ**, is an order of muscular fibres intermixed with membranous fibres surrounding the Vagina Uteri near its orifice; it is connected to the Os Pubis and Sphincter Ani; its use is to constrict the orifice of the Vagina, to press out a liquor from the glands of the Vagina, and embrace the Penis in coition.

Dr. DOUGLAS mentions two pair of muscles of the Vagina of his own discovering, which I have never dissected, and will therefore give them in his own words: The first arises from the inner edge of the Os Pubis mid-way between the Ischion and the beginning of the Crus Clitoridis, is inserted into the Vagina; the second arises tendinous and fleshy from the Os Pubis internally in common with the Levator Ani, is inserted into the upper part of the Vagina at the side of the Meatus Urinarius or Collum Vescicæ.

**SPHINCTER**

**SPHINCTER ANI**, is a muscle near two inches in breadth, surrounding the Anus to close it, and to prevent involuntary falling out of the *Fæces*. Muscles of the Anus.

**LEVATOR ANI**, by Dr. Douglass, called two pair of muscles, but Mr. Cowper describes the whole as one muscle only, which arises from the *Ossa Ischii*, *Pubis*, and *Sacrum* within the *Pelvis*, and is inserted round the lower end of the *Rectum Intestinum*.

**FISTULA's** in *Ano*, that are within this muscle, generally run in the direction of the gut, and may be laid open into the gut with great safety; but those fistula's, or rather abscesses that are frequently formed on the outside of the Sphincter, and usually surround it, all but where this muscle is connected to the *Penis*, cannot be opened far into the gut, without totally dividing the Sphincter, which, Authors say, renders the Sphincter ever after incapable of retaining the excrement. One instance of this kind I have known; but Mr. Berbeck, of *York*, an excellent surgeon, and particularly famous for this operation, has assured me, that he has often been forced to divide the Sphincter, which has made the patients unable to hold their excrements during their cure, but the wounds being healed, they have retained them as well as ever.

**GOCYGEI** arise from the acute processes of the *Ossa Ischii*, and are inserted into the *Os Coccygis*, which they pull forward. Muscles of the Os Coccygis.

**OCCIPITO-FRONTALIS**, is a muscle with four fleshy bellies, commonly named *Frontales*. Muscles of the Scalp.

and Occipitales. It arises behind each ear from the Os Occipitis, and soon becoming tendinous, passes under the hairy scalp to the forehead, where it becomes broad and fleshy, adhering to the skin, and is inserted into the upper part of the orbicular muscles of the eye-lids into the Os Frontis near the nose, and by two processes into the bones of the nose. When this muscle acts from the back-part, it pulls the skin of the forehead upward, and wrinkles it transverse, and in some persons the hairy scalp backwards; but when the fore-part of it acts, it draws the skin with the eye-brows downward, and towards the nose when we frown. The tendon of this muscle has been mistaken for a membrane, and been called Pericranium, and the true Pericranium, Periosteum.

Muscles  
of the ex-  
ternal ear.

**ELEVATOR AURICULÆ**, arises from the tendon of the Occipito-Frontalis, and is inserted into the upper part of the ear that is connected to the head.

**RETRACTOR AURICULÆ**, arises by one, two or three small portions from the temporal bone above the mamillary process, and is inserted into the ear to pull it backward.

Muscles  
of the  
eye-lids.  
Tab. x. D.

**ORBICULARIS PALPEBRARUM**, surrounds the eye-lids on the edge of the orbit, and is fixed to the Sutura Transversalis at the great corner of the eye; it shuts the eye-lids, especially in winking. That part of this muscle that lies under the eye-brow is very much intermixed with the Occipito-Frontalis, and under it from the Os Frontis near the nose, arises a small portion of distinct



distinct fibres which end in this muscle, and, I think, are a part of it; nevertheless, from the effect of their action, are not improperly called *Musculus Corrugator*.

**CILIARIS**, is a very small portion of this muscle, next the ciliary cartilages of the eye-lids.

**ELEVATOR PALPEBRÆ SUPERIORIS RECTUS**, arises above the optick nerve, from the Periosteum at the bottom of the orbit (as do also the five following muscles) and is inserted into the whole ciliary cartilage of the upper eye-lid by a very thin flat tendon.

**ELEVATOR OCULI**, arises from the bottom of the orbit, between the optick nerve and the foregoing muscle, and is inserted into the upper part of the Tunica Sclerotis of the eye, near the Cornea. Muscles of the eyes. Tab. x. Q.

**DEPRESSOR OCULI**, arises, and is inserted directly opposite to the last described muscle. Tab. x. R.

**ADDUCTOR OCULI**, arises from the bottom of the orbit, near the optick nerve internally, and is inserted into the Tunica Sclerotis on the side next the nose. Tab. x. S.

**ABDUCTOR OCULI**, has both its origin and insertion, directly opposite to the Adductor. Tab. x. T.

**OBLIQUUS SUPERIOR, seu TROCHLEARIS**, arises between the Elevator and Adductor Oculi at the bottom of the orbit, thence ascending by the Sutura Transversalis, becomes a round tendon, which passing through a pulley at the upper and inner part of the orbit near its edge, is inserted near the bottom of the globe of the eye, which Tab. x. N. Tab. x. O.



which it pulls upward and inward, and thereby directs the pupil outward and downward.

Tab. x. P. **OBLIQUUS INFERIOR**, arises from the Os Maxillæ Superioris, at the edge of the orbit; thence passing over the Depressor is inserted near the Abductor at the bottom of the eye, but not so low as the insertion of the Obliquus Superior: It turns the pupil upward and outward.

THESE muscles are inserted with great Advantage to move a small weight, and are very long, that the eye may be moved with sufficient quickness. The two oblique muscles are an Axis to the motions of the other four, and acting strongly against them, (which action I take to be what is vulgarly called straining the eye) may, I think, bring the crystalline humour nearer to the Retina, and even make the crystalline humour more flat to fit the eye for objects at a great distance; for this end it seems to me that there are six muscles thus disposed, when three would be sufficient to turn the eye every way, if it was in a fixed socket; and it seems also that while the muscles are all thus in action, the superior oblique in each eye sets the pupil farther from the nose, while the inferior oblique directs it upward; the first of which actions is always necessary, and the latter often so, when we look with both eyes at very distant objects; and when the two oblique muscles grow weak by age or disease, or cease to act at all, as in paralytick cases, and death, then the eye sinks in the orbit.

Muscles of the Lips. Tab. x. E. **SPHINCTER OR CONSTRUCTOR ORIS**, surrounds the mouth about three fourths of an inch

inch broad. This muscle is very much intermixed with all the muscles that are inserted into it.

**ELEVATOR LABII SUPERIORIS PROPRIUS**, arises from the bone of the upper jaw under the anterior and inferior part of the Orbicularis Palpebrarum, and usually takes another small beginning from the Os Malæ, which seems as if it was sent off from the Orbicularis Palpebrarum; and passing down by the side of the nose, into which it sends some fibres, is inserted into the upper part of the Sphincter Oris. This raises the upper lip, and helps to dilate the nostrils. Tab. x. F.

**DEPRESSOR LABII SUPERIORIS PROPRIUS**, is a small muscle arising from the upper jaw near the Dentes Incisorii, and is inserted into the upper part of the lip and root of the cartilages of the nose; hence it is also a depressor of the nose, which action constricts the nostrils.

**DEPRESSOR LABII INFERIORIS PROPRIUS**, arises broad from the lower jaw at the chin, Tab. xiii. l. and is soon inserted into the Sphincter Oris; the order of fibres in this seems not so conspicuous as in the other muscles of the face.

**ELEVATOR LABII INFERIORIS PROPRIUS**, arises from the lower jaw, near the Dentes Incisorii, and is inserted into the lower part of the lip.

**ELEVATOR LABIORUM COMMUNIS** arises from a depressed part of the Superior Maxilla Tab. xiii. G. under the middle of the orbit, and is inserted into the Sphincter muscle near the corner of the mouth.

**DEPRES-**

Tab. xiii. **DEPRESSOR COMMUNIS LABIORUM**, arises laterally from the lower jaw near the chin, and is inserted into the Sphincter, opposite to the former.

Tab. xiii. **ZYGOMATICUS**, arises from the anterior part of the Os Zygoma or Malæ, and frequently derives a portion of fibres from the Orbicularis Palpebrarum, thence running obliquely downwards; it is inserted into the Sphincter at the corner of the mouth betwixt the Elevator Communis and Buccinator; it draws the corner of the mouth outward and upward. When this muscle grows weak, the corner of the mouth sinks, as may be observed in old persons.

Tab. xiii. **BUCCINATOR**, arises from the Processus Coronæ of the lower jaw, and passing contiguous to both jaws, is inserted into the Sphincter muscle at the corner of the mouth. It serves either to force breath out of the mouth, or thrust the aliment between the teeth in mastication, or to pull the corner of the mouth outward.

**PLATYSMA MYOIDES**, arises loosely from over the pectoral and part of the deltoid muscle, and running obliquely forward, is inserted into the chin, and depressor muscles of the lips. This muscle being exceeding thin (a mere Membrana Carnosa) serves to cover the unequal surface of the subjacent muscles, and render the neck even; it also pulls down the corner of the mouth, and from its insertion at the chin, may contribute to the pulling down of the lower jaw.

Muscles  
of the  
nose.

**RETRACTOR ALÆ NASI**, is a very small muscle arising from the bone of the nose, and is insert-

inserted into the skin and cartilage at the side of the nose.

**MYLOHYOIDEUS**, with its fellow, may be esteemed one penniform or else a digastrick muscle: It arises from the Linea Aspera on the inside of the lower jaw and Processus Innominatus, both sides meeting at about right angles in a middle line upon the following muscles. It is inserted by a small portion of fibres into the Basis of the Os Hyoides; it moves the tongue upward and forward, and also compresses the following muscles, whereby they raise the tongue more commodiously, and also hinders them from drawing the Basis of the Os Hyoides into a right line betwixt the chin and Sternum at such times as the Stylohyoidei cannot act.

Muscles  
of the Os  
Hyoides.

**GENIOHYOIDEUS**, arises from the Processus Innominatus of the lower jaw, under the foregoing muscle, and is inserted into the Basis of the Os Hyoides, which it pulls upward and forward. This with its fellow, are for the most part but one muscle.

Tab. xii.

**STYLOHYOIDEUS**, arises from the Processus Styloformis near its root, and passing contiguous to the horn of the Os Hyoides becomes inserted laterally into its Basis. This muscle is sometimes perforated about the middle by the tendon of the digastrick muscle of the lower jaw. Its use is to pull the Os Hyoides up and backward.

**CORACOHYOIDEUS**, arises from the upper Costa of the Scapula near the Processus Coracoideus, and passing under the Mastoideus muscle becomes in that place a round tendon; thence passing

sing



sing almost parallel to the following muscle, is inserted together with it into the Basis of the Os Hyoides; this draws the Os Hyoides downward, and a little backward. I have once seen one of these muscles wanting, and the Sternohyoideus arising from the middle of the clavicle on that side.

Tab. xii. STERNOHYOIDEUS, arises from a roughness at the under part of the Clavicula near the Sternum, and the cartilaginous part of the first rib; and is inserted into the Basis of the Os Hyoides, to pull it downward.

Muscles of the tongue. GENIOGLOSSUS, arises from the Processus Innominatus of the lower jaw, and is inserted broad into the under part of the tongue, to pull it up and forward, and sometimes has a small insertion into the Os Hyoides.

BASIOGLOSSUS seems a portion of the former muscle; it arises from the Basis of the Os Hyoides, and is inserted into the tongue nearer its tip.

CERATOGLOSSUS, arises from the horn of the Os Hyoides, and is inserted laterally into the tongue near its root, to pull it downward and forward.

STYLOGLOSSUS, arises from the extremity of the Processus Styloformis, and is inserted into the tongue near the former to pull it up and backward. I have very often found another styloid muscle so inserted, that I cannot tell whether to call it a muscle of the tongue or Pharynx.

THE Tongue is a muscle made of fibres, longitudinal, circular, and transverse, so intermixt as best to serve its several motions.



**HYOTHYROIDÆUS** or **CERATOTHYROIDÆUS**, arises from part of the Basis, and the horn of the Os Hyoides, and is inserted into the lower part of the Cartilago Thyroides, to pull it upward. Muscles of the Cartilago Thyroides.

**STERNOTHYROIDÆUS**, arises from the inside of the Sternum, and is inserted with the former; it pulls the thyroid cartilage directly downward.

**CRICOTHYROIDÆUS**, arises from the anterior part of the Cartilago Cricoides, and running obliquely upward and outward, is soon inserted into the inside of the Cartilago Thyroides, which it pulls towards the Cartilago Cricoides. Both this muscle and its fellow, for the most part appear double.

**CRICOARYTÆNOIDEUS POSTICUS**, arises from the back-part of the Cartilago Cricoides, and is inserted into the Arytænoides to pull it backward. Muscles of the Cartilago Arytænoides.

**CRICOARYTÆNOIDEUS LATERALIS**, arises laterally from the Cartilago Cricoides, and is inserted laterally into the Arytænoides. This with its fellow, pull down each cartilage toward their origin, and thereby dilate the Rimula.

**THYROARYTÆNOIDEUS**, arises from the superior, middle, and inner part of the Cartilago Thyroides, and is inserted with the former into the Arytænoides cartilage to dilate the Rimula. These two last described muscles are not naturally divided, and therefore ought to be accounted but one muscle.

ARYTÆNOIDEUS, is one single muscle arising from one arytænoidal cartilage, and is inserted into the other to draw them together, and close the Rimula. These few small muscles of the tongue and Larynx, with only one pipe, make a greater variety of notes and sounds than can be made by artificial instruments, and that in a manner so little understood by us, and by organs so little differing from those in quadrupeds, that for ought we know of them, brutes might be as capable of all these sounds as men.

Muscles  
of the  
Pharynx.

STYLOPHARYNGEUS, arises from near the bottom of the Processus Styloides of the Os Petrosus, and running obliquely downward, is inserted into the Pharynx. This muscle with its fellow, pulls up and dilates the Pharynx to receive the aliment.

ŒSOPHAGEUS, arises like a wing from several parts of the skull, tongue, Os Hyoides, the cricoid and thyroid cartilages, and is inserted into the Pharynx. This with its fellow constricts the Pharynx, and presses the aliment down the gullet.

MUSCULUS VAGINALIS GULÆ, is the muscular coat of the Gula.

PTERYGOPHARYNGEUS, is not a distinct muscle, but the beginning of the Pharynx near the Processus Pterygoideus, of the sphenoidal bone.

Muscles  
of the  
Palate.

PTERYGOSTAPHYLINUS INTERNUS, arises from the Os Sphenoides, near the Iter ad Palatum, or Eustachian tube, and is inserted into the Uvula, which it pulls up while we breathe through the mouth or swallow.

PTERY-

**PTERYGOSTAPHYLINUS EXTERNUS**, arises by the side of the last described muscle, and is also inserted near it; but becomes its antagonist by being reflected on a pulley, over a process at the lower part of the pterygoid processes of the sphenoidal bone.

**GLOSSO-STAPHYLINUS**, is a very small portion of muscular fibres, which pass from the tongue to the palate, which it pulls down when we breathe through the nose.

**THE** palate it self is a sort of double muscle, whose action seems only to support it self and assist those muscles which pull it upwards.

**DIGASTRICUS**, arises from the Sinus of the <sup>Muscles</sup> mamillary process of the Os Temporis, and from <sup>of the</sup> a fleshy belly, becoming a round tendon, passes <sup>lower</sup> jaw. through, and sometimes under the Stylohyoideus muscle; and then being tied down by a ligament to the Os Hyoides, grows fleshy, and is to inserted into the anterior part of the lower jaw internally. This muscle's direction being altered by its being tied to the Os Hyoides, where it makes an angle, (and not at its passage through the Stylohyoideus) pulls the lower jaw downward with much greater force than otherwise it could have done: and being connected to the Os Hyoides, when it acts it prevents the action of several muscles which are concerned in swallowing; whence it is that we cannot swallow at the same time, that we open the jaw, as those brutes can whose digastric muscles are not connected to that bone.

**TEMPORALIS**, arises from the Os Frontis, Tab. xiii. Parietale, Sphenoides, Malæ and Temporis, and B.

G 2, ... passing

passing under the two processes named Os Jugale, is inserted externally into the Processus Coronæ of the lower jaw, which it pulls upward. This muscle is covered with a strong tendinous Fascia.

Tab. xiii. C. **MASSETER**, arises from the lower edge of the Os Malæ or Zygoma, and the process which joins this from the temporal bone, and is inserted to the outer part of the angle of the lower jaw, which it pulls up and forward. These two last described muscles having different Directions, when they act together, make a steady motion in the diagonal of their directions.

**PTERYGOIDEUS INTERNUS**, arises from the Processus Pterygoideus Externus, and from the Sinus between the pterygoid processes, and is inserted internally into the angle of the lower jaw, which it pulls upward.

**PTERYGOIDEUS EXTERNUS**, arises from the Os Maxillare, and Os Sphenoides, near the root of the external pterygoid process, and is inserted internally into the Processus Condylodes of the lower jaw, which it pulls to one side, and forwards, or acting with its fellow, pulls the jaw directly forwards.

Muscle of the Clavicula. **SUBCLAVIUS**, arises from the superior part of the first rib, and is inserted into more than half the underside of the clavicle next the Scapula. Its use is to draw the Clavicula toward the Sternum, that they may not be severed in the motions of the Scapula.

Muscles of the Scapula. Tab. xiii. **TRAPEZIUS**, arises from the Os Occipitis, and from a Linea Alba Colli, from the spinal process of the last Vertebra of the neck, and the



ten uppermost of the back, and from a *Linea Alba* between all these Processes, and is inserted into one third of the clavicle next the Scapula, almost all the back part of the spine of the Scapula, and as much of the *Processus Acromion* as lies between the spine of the Scapula and the clavicle. This muscle draws the Scapula directly backward.

It is generally said by authors, that the several parts of this muscle act at different times, and so pull the Scapula different ways, as obliquely upward, downward or backward; but, I think, if that happened, it must necessarily divide this muscle into distinct portions, those that contract always separating from those that do not.

**RHOMBOIDES**, arises tendinous under the *Tab. xiii.* former from the spinal process of the Inferior Vertebra of the neck, part of the *Linea Alba Colli*, and from the spinal processes of the four or five uppermost Vertebrae of the Thorax, and is inserted into the Basis of the Scapula, which it pulls up and backward. The upper part of this muscle arising from the neck, is in many bodies, by the motions of the neck, separated and made a distinct muscle.

**ELEVATOR SCAPULÆ**, arises from the transverse Processes of the four superior Vertebrae of the neck, and is inserted into the upper angle of the Scapula.

**SERRATUS MINOR ANTICUS**, arises under the *Pectoralis*, from the third, fourth and fifth ribs, and is inserted into the *Processus Coracoïdes Scapulæ*; which it pulls forward and downward.



ward. This muscle is always said to be an Elevator of the ribs, though it arises from the Scapula, which is supported by the ribs.

**SERRATUS MAJOR ANTICUS**, arises from the anterior part of the eight superior ribs, and is inserted into the Basis of the Scapula, which it draws forward, and by that means moves the socket of the Scapula upward. This muscle has been always accounted an Elevator Costarum, though each portion of it is nearly parallel to the rib it rises from.

**ALL** the muscles inserted into the Basis of the Scapula, are also inserted into one another.

Muscles  
of the  
Humerus  
Tab. xii. 7.

**PECTORALIS**, arises from near two thirds of the Clavicula, next the Sternum, and all the length of the Os Pectoris, and from the cartilages of the ribs, and is inserted into the Os Humeri, between the Biceps and the insertion of the Deltoides. The use of it is to draw the arm forward. A small portion of the lower part of this muscle is often confounded with the Obliquus Descendens Abdominis; and in some bodies, neither the upper part, nor its tendon, can be easily separated from the Deltoides; and in others, even that part of it that arises from the Clavicula, is a distinct portion. Near the insertion of this muscle, the fibres cross those from below, ending above in the arm, and those from above below, that the tendon of this muscle might not lie inconveniently low between the arm and Thorax, as it would have done, had the fibres which arise lowest from the Sternum been inserted lowest in the arm: but this crossing does not make the tendon

don at all stronger, as is often said; nor can I see how it came to be thought that this tendon should want more strength in proportion, than other tendons.

**DELTOIDES**, arises exactly opposite to the Tab. xii. 5. insertion of the Trapezius, from one third part of the Clavicula, from the Acromion and spine of the Scapula, and is inserted tendinous near the middle of the Os Humeri, which bone it lifts directly upward. The outermost parts of this muscle, when the arm hangs down, lie below the center of motion of the joint, and therefore can have no share in lifting the Humerus up till it is raised part of the way by the other part of this muscle, and the following muscle; and as the outer parts of this muscle begin to act, the following muscle acts with less advantage: And it seems to me, that the sole reason why this muscle is made of so many parts, is, that they may act independently; for it is demonstrable, that this muscle, when the whole of it acts, cannot raise the arm with so great advantage as a right-lined muscle of the same magnitude would have done.

**SUPRASPINATUS**, arises from the Dorsum Scapulæ above the spine, and passing between the two processes, is inserted into the upper part of the Os Humeri, which it helps to raise, until it becomes parallel with the Spina Scapulæ.

**THE** Supraspinatus, the Deltoides and Coracobrachialis, assist in all the motions of the Humerus, except depression; it being necessary that the arm should be raised and sustained, in order to move it to any side.

Tab. xiii.  
8.

**INFRASPINATUS**, arises from the *Dorsum Scapulæ* below the spine, and is inserted (wrapping over part of it) at the side of the Head of the *Os Humeri*; it turns the arm supine and backward; for there is a prone and supine rotatory motion of the *Humerus* of near 90 Degrees.

**TERES MINOR**, is a small muscle arising below the former from the *Inferior Costa Scapulæ*, and is inserted together with it. It assists the former in turning the arm supine, but pulls it more downwards.

Tab. xiii.  
7.

**TERES MAJOR**, arises from the lower angle of the *Scapula*, and is inserted at the under part of the *Os Humeri* about three fingers breadth from the head. This draws the *Os Humeri* toward the lower angle of the *Scapula*, and turns the arm prone and backward.

Tab. xiii.  
6.

**LATISSIMUS DORSI**, arises by a flat tendon from the spinal processes of the seven or eight inferior *Vertebræ* of the back, and those of the loins, *Sacrum* and *Ilium*; and growing fleshy after it has passed the extensors of the trunk, receives another small fleshy beginning from the ninth, tenth and eleventh ribs, and is inserted into the *Os Humeri*, with the former. This turns the arm backward and prone. The tendon of this muscle serves for a membrane to the extensors of the back, and is connected to the transverse processes of the *Vertebræ Lumborum*.

**SUBSCAPULARIS**, arises from the hollow side of the *Scapula*, which it fills up, and is inserted into the head of the *Os Humeri*, wrapping somewhat

somewhat over it. This pulls the arm to the side, and prone.

**CORACOBRACHIALIS**, arises from the Processus Coracoides Scapulæ, in common with the insertion of the Serratus Minor Anticus, and is inserted into the Os Humeri internally about its middle. This raises the arm, and turns it somewhat outward.

**BICEPS CUBITI FLEXOR**, arises with two heads, (that the fibres of this muscle might not compress one another;) one from the Processus Coracoides Scapulæ, in common with the Coracobrachialis muscle, and the other by a round tendon from the edge of the Acetabulum Scapulæ, which passing in a Sulcus of the Os Humeri, afterward becomes fleshy, and joins the first head to be inserted with it into the tubercle of the Radius; and sometimes this muscle has a third head, which arises from the middle of the Os Humeri. This muscle lifts up the Humerus, bends the cubit, and has as great a share as any one muscle in turning the cubit supine; the Humerus being fixed by other muscles, the whole force of this muscle will be exerted upon the cubit, or the cubit being fixed by an Extensor, the whole force of it will be spent in raising the arm, and therefore ought to be always reckoned among those that raise a weight at arms length. A puncture of the tendinous expansion of this muscle is supposed to be always attended with grievous pain and inflammation, and has, if we have not mistaken the cause, sometimes proved mortal; yet the best of surgeons, and particularly Mr. Cowper, has given

Muscles  
of the  
Cubit.  
Tab. xii.  
12.



ven us instances of larger tendons being cut and stitched, without any bad symptoms; and I have often seen them ulcerated and mortified, without any more sign of pain than in other Parts: So that I cannot see what the great Mischief of pricking this tendinous Fascia is owing to, unless its lying so much upon the stretch, which may be wholly avoided by bending the elbow, and turning the cubit prone. Since I have considered this case, I have met with only one, which was thus injured by an injudicious blood-letter, who ordered the patient to keep her arm extended for fear of a contraction, and she was not without the most violent pain for a whole fortnight; but upon bending the cubit, and turning the arm prone, she grew presently easy, and, in a few days, well. Nevertheless, I am persuaded that most of the accidents which are thought to be merely from blood-letting are critical discharges of some Disease, and from the puncture a small inflammation beginning, encreases and suppurates: But however singular I may be thought in this opinion, I can be sure I am disinterested in it, having never had any ill accident follow blood-letting in my life.

Tab. xii. 13. **BRACHEUS INTERNUS**, arises from below the middle of the Os Humeri, and is inserted into a rough place of the Ulna immediately below the juncture. This also bends the cubit.

**SUPINATOR RADII LONGUS**, arises from the lower and outer part of the Os Humeri, and is inserted into the upper side of the Radius, near the Carpus. This muscle is not a Supinator,



tor, but a bender of the cubit, and that with a longer lever than either of the two former muscles, and is less concerned in turning the cubit supine, than either the extensors of the Carpus, fingers or thumb.

**TRICEPS EXTENSOR CUBITI**, commonly Tab. viii. distinguished into Biceps and Bracheus Externus. 9.

The first of these heads arises from the lower Costa of the Scapula near the Acetabulum; the second from the outer and back-part of the Os Humeri; the third, lower and more internal; and are inserted into the Processus Olecranon of the Ulna. The first of these heads draws the arm backward, with as long a lever as it extends the cubit.

**ANCONÆUS**, arises from the outward extuberance of the Os Humeri, and is inserted into Tab. xiii. 10. the upper part of the Ulna: This is also an Extensor.

**PALMARIS LONGUS**, arises small from the inner extuberance of the Os Humeri, and from a Muscles of the Palm of the hand. short belly soon becomes a tendon, which is connected to the Ligamentum Transversale Carpi, and expanded in the palm of the hand. This muscle is often wanting, but the expansion in the hand never; yet it being connected to the ligament of the Carpus, it must bend the Carpus, and cannot constrict the palm of the hand; and when it is wanting the Flexor Carpi Radialis is larger.

**PALMARIS BREVIS** or **CARO QUADRATA**, arises obscurely from the Ligamentum Transversale Carpi, and seems to be inserted into the eighth bone of the Carpus and the metacarpal bone

bone of the little finger. This helps to constrict the palm of the hand, and is very different in size in different bodies.

Muscles  
of the  
Carpus.

**FLEXOR CARPI RADIALIS**, arises from the inner extuberance of the Os Humeri, and soon becoming a strong tendon, passes through a channel of the fifth bone of the Carpus, and is inserted into the metacarpal bone of the fore-finger; this not only bends the Carpus upon the Radius, but also the bones of the second order upon those of the first; which motion is nearly as much as that upon the Radius.

**FLEXOR CARPI ULNARIS**, arises from the same extuberance with the former, and a Fascia betwixt this muscle and the Tensor Ulnaris, contiguous to the Ulna, and is inserted by a short tendon into the fourth bone of the Carpus.

Tab. xiii.  
12.

**EXTENSORES CARPI RADIALES**; the first arises from the Os Humeri immediately below the Supinator Radii Longus, and is inserted into the metacarpal bone of the first finger; the second arises immediately below this, from the outer extuberance of the Os Humeri, and is inserted into the metacarpal bone of the second finger. The first of these muscles is a bender of the cubit as well as an extensor of the Carpus, and its often acting with the benders of the cubit while the other is not in action, is the reason why it is so distinct from it.

**EXTENSOR ULNARIS**, arises from the same extuberance with the former, and half the Ulna below the Anconeus muscle; then becoming a tendon, runs in a small Sinus at the bottom of the Ulna,

Ulna, and is inserted into the metacarpal bone of the little finger. See Ulna. page 36. The extensors of the Carpus being inserted into the Metacarpus at once perform the motion between the bones of the Carpus, and that between the Carpus and Radius. The Flexor and Tensor Ulnaris acting together turn the hand downward, the Tensor and Flexor Radialis upward.

**PERFORATUS** or **FLEXOR SECUNDI INTERNODII DIGITORUM**, arises from the inner tubercle of the Os Humeri, and from the upper part of the Ulna, and the middle of the Radius; then becoming four strong tendons, passes under the Ligamentum Transversale Carpi, and is inserted into the beginning of the second bone of each finger. Muscles of the fingers.

**PERFORANS** or **FLEXOR TERTII INTERNODII DIGITORUM**, arises from half the Ulna, and a great part of the ligament between the Ulna and Radius, then becoming four tendons, passes under the Ligamentum Transversale Carpi, and through the tendons of the former muscle to their insertion into the third bone of each finger. The tendons of both these muscles are tyed down to the finger by a strong ligament. If these muscles had not passed one through the other, the Perforatus, which is the lesser muscle, must have gone to the last joint, where the stronger muscle is wanted; and besides, the tendons of the second joints would have pressed those that bend the last, and not lain firmly upon them neither.

LUMBRICALES or FLEXORES PRIMI INTERNODII DIGITORUM, arise from the tendons of the last mentioned muscle, and are inserted laterally toward the thumb into the beginning of the first bone of each finger.

Tab. xiii.  
134

EXTENSOR DIGITORUM COMMUNIS, arises from the outer extuberance of the Os Humeri, and passing under a ligament, at the wrist, is divided into four tendons which communicate upon the first joint, which keeps them from sliding off the joints of the fingers, where they are a little connected to the first bones, and afterward are inserted into the beginning of the second bone of each finger.

EXTENSOR AURICULARIS or MINIMI DIGITI, is a portion of the last muscle passing under the ligament in a distinct chanel.

EXTENSOR INDICIS, arises from the middle of the Ulna, and passing under the ligament of the Carpus, is inserted with the Extensor Communis into the fore-finger. This muscle extends the fore-finger singly. I have twice seen it wanting.

ABDUCTOR PRIMI DIGITI, INTEROSSEI and ABDUCTOR MINIMI DIGITI, are eight muscles, one for each side of each finger. ABDUCTOR PRIMI DIGITI, arises from the first bone of the thumb, and the side of the metacarpal bone of the first finger. The INTEROSSEI, are three pair fitly divided into external and internal; the external arise from the metacarpal bones, whose spaces they fill up next the back of the hand; the internal arise from the same bones in the inside of the hand. ABDUCTOR MI-

NIMI



**NIMI DIGITI**, arises from the transverse ligament, and fourth bone of the Carpus; these muscles are inserted, two into the first joint of each finger, and then passing obliquely over the tops of the fingers are inserted into their last bones; they bend the first joints, and extend the two last, as in holding a pen, and in playing upon some musical instruments. The Abductors of the fore and little fingers, with the second and fifth Interossei muscles acting, the fingers are divaricated, and the other four acting bring them together, and these muscles which divaricate the fingers, being extenders of the second and third Joints, we never can divaricate them without extending them a little.

**ADDUCTOR OSSIS METACARPI MINIMI DIGITI**, arises from the eighth bone and transverse ligament of the Carpus, and is inserted into the metacarpal bone of the little finger, which it pulls toward the thumb to constrict the palm of the hand.

**EXTENSOR PRIMI INTERNODII POL-  
LICIS**, arises from the Ulna below the Ancone-  
us muscle, and the ligament between the Ulna  
and Radius; then becoming two, three, or four  
tendons is inserted into the fifth bone of the  
Carpus, and first of the thumb. The first  
of these Insertions can only assist the bending  
of the wrist upward, and in turning the arm su-  
pine.

Muscles  
of the  
thumb.

**EXTENSOR SECUNDI INTERNODII POL-  
LICIS**, arises immediately below the former  
from the Radius and transverse ligament, and is  
inserted



inserted by a few fibres into the second bone of the thumb, but chiefly into the third.

**EXTENSOR TERTII INTERNODII POLLICIS**, arises immediately below the last described, from the Ulna and ligament, and passes over the Radius nearer the Ulna to be inserted at the third bone of the thumb. This extends the thumb more toward the Ulna than the former muscle, and is very much a Supinator.

**FLEXOR PRIMI & SECUNDI OSSIS POLLICIS**, arises from the fifth bone and transverse ligament of the Carpus, and from the beginnings of the two first metacarpal bones, and is inserted into the whole length of the first bone of the thumb, and tendinous into the beginnings of the second; the sesamoid bones of the thumb, in such bodies as have them, lie in this tendon, where it passes over the joint.

**FLEXOR TERTII INTERNODII POLLICIS**, arises large from almost all the upper part of the Radius, and becoming a round tendon passes under the *Ligamentum Transversale Carpi* to be inserted into the third bone of the thumb. This muscle singly acting, draws the thumb towards the metacarpal bone of the little finger; but the last mentioned muscle acting with it, turns it toward the fore-finger.

**ADDUCTOR POLLICIS**, arises from the Carpus, and almost the whole length of the metacarpal bone of the long finger, and is inserted into the beginning of the second bone of thumb. This muscle naturally enough divides into two, and

and might better be called a Flexor than Adductor.

**ABDUCTOR POLLICIS**, arises from the fifth bone and Ligamentum Transversale of the Carpus, and is inserted laterally in the beginning of the second bone of the thumb to draw it toward the Radius.

**THE** muscles which bend the thumb are much less than those which bend the fingers; nevertheless, the thumb is able to resist all the fingers, merely from the advantages that arise from the thickness and shortness of the bones of the thumb, compared with those of the fingers; but then the quickness of motion in the fingers will exceed that of the thumb, as much as the fingers exceed the thumb in length, and their muscles those of the thumb in largeness.

**SUPINATOR RADII BREVIS**, arises from Muscles of the Radius. the outer extuberance of the Os Humeri and upper part of the Ulna, and running half round the Radius, is inserted near its tubercle.

**PRONATOR TERES**, arises from the inner Apophysis of the Os Humeri, and upper and forepart of the Ulna, and is inserted tendinous into the Radius below the former.

**PRONATOR QUADRATUS**, arises from the lower edge of the Ulna near the Carpus, and passing under the flexors of the fingers, is inserted into the Radius.

**THESE** muscles are occasionally assisted in their actions by the muscles of the hand; most of the extensors assisting the supinators, and most of the flexors the pronators, and most of the exten-

fors of the hand take a great part of their origin from the tendinous Fascia that covers them.

Muscles  
of the  
head and  
neck.  
Tab.xii.2.

MASTOIDEUS, arises tendinous from the Sternum near the Clavicula, and by a separate fleshy portion from the Clavicula, which soon unites with the other beginning, and is inserted into the outer part of the mamillary process of the temporal bone. It pulls that side of the head it is inserted into towards the Sternum, and turns the face over the contrary shoulder. This with its fellow, pull the head and neck toward the breast, and act with a much longer lever upon each lower Vertebra, than they do upon the next above, and with more power upon any of those bones than upon the head. This muscle being inserted into the head, beyond the center of motion of the head with the first Vertebra, has been supposed by Mr. Cowper, and others, to pull the head backward; but passing beyond signifies nothing to that purpose, unless a line passing through its Axis would pass below the center of motion: And it is the more to be wondered how this mistake prevailed, if we consider that this muscle's being added to the extensors of the head and neck, would make the force of that action a hundred times greater than that of the benders. And if this is not enough to convince, let any one lying on his back raise his head, and he will soon feel this muscle in action; but bowing the head forward in an erect posture will not shew this, unless some resistance is made to the head, because the center of gravity of the head lying before the center of motion, there needs no more than a relaxa-

relaxation of the extensors, to bring the head forward in that posture.

**RECTUS INTERNUS MAJOR**, arises from the anterior part of the transverse processes of the third, fourth, fifth and sixth cervical Vertebrae; and passing over the two superior, is inserted into a roughness of the occipital bone near the forepart of the great Foramen. This bends the head on the two first Vertebrae of the neck.

**RECTUS MINOR INTERNUS**, arises under the last muscle, from the first Vertebra, and is inserted under it into the Os Occipitis. This bends the head on the first Vertebra.

**RECTUS LATERALIS**, arises from the anterior part of the transverse process of the first Vertebra of the neck, and is inserted into the Os Temporis and Occipitis between the mamillary and styloid processes. This turns the head to one side.

**SPLenius**, arises by a thin tendon from the spinal processes of the five superior Vertebrae of the Thorax, and the lowest of the neck, and *Linea Alba Colli*, and is inserted into the Os Occipitis, the upper part of the Mamillary process of the temporal bone, and the transverse processes of the three superior cervical Vertebrae. This pulls the head and neck backward, and to the contrary side; but both of these acting together pull them directly backward.

**COMPLEXUS**, arise from the transverse processes of the six or seven superior Vertebrae of the Thorax, and six inferior of the neck, and is inserted into the Os Occipitis, and backpart of the

*Of the Muscles.*

*Os Temporis*; this last part is sometimes distinct enough to be accounted another muscle: It pulls the head and neck back.

*RECTUS MAJOR POSTICUS*, arises from the spinal processes of the second Vertebra of the neck, and is inserted broader into the *Os Occipitis*. It pulls the head back on the two first Vertebrae.

*RECTUS MINOR POSTICUS*, arises from the back-part of the first Vertebra of the neck, (it having no spinal process) and is inserted below the former into the same bone to pull the head back on the first Vertebra.

*OBLIQUUS SUPERIOR*, arises from the transverse process of the first Vertebra, and is inserted into the *Os Occipitis* and back-part of the *Os Temporis* near the *Rectus Major*; either of these acting, assist the *Rectus Lateralis* on the same side; but both together, pull the head back.

*OBLIQUUS INFERIOR*, arises from the spinal process of the second Vertebra of the neck, and is inserted into the transverse process of the first. This, with its fellow, alternately acting, turn the head with the first Vertebra in a rotatory manner on the second, whose *Processus Densatus* is the Axis of this motion.

*INTERSPINALES COLLI*, are three or four pair of muscles between the bifid processes of the cervical Vertebrae, which they draw nearer each other when the neck is bent backward.

*LONGUS COLLI*, arises laterally from the bodies of the four superior Vertebrae of the Thorax, and



and from the anterior part of the transverse processes of the five inferior Vertebrae of the neck, and is inserted into the forepart of the first and second Vertebrae of the neck, which it bends forward.

**INTERTRANSVERSALES COLLI**, are portions of flesh between the transverse processes of the Vertebrae of the neck, like the Interspinales, but not so distinct; they draw these processes together.

**SPINALIS COLLI**, arises from the transverse processes of the five superior Vertebrae of the back, and is inserted into the spinal processes of the second, third, fourth and fifth Vertebrae of the neck. This pulls the neck backward.

**TRANSVERSALIS COLLI**, arises from the oblique processes of the four inferior Vertebrae of the neck, and is inserted into the spinal process of the second Vertebra of the neck. This muscle is but a continuation of the Transversalis or Semispinalis Dorsi.

**THE** muscles of the head and neck are most of them obliquely directed, which makes them perform the oblique motions, as well as extension and flexion; which is highly convenient in this case, because the joints moved by these muscles, being under the weight moved, it is necessary that the head should be kept steady by the extensors, and flexors too, when any great weight is upon the head; and these muscles from the obliquity of their directions, not only perform these two actions at once, but acting by pairs they move the head and neck steadily, in a diagonal

H 3                      direction,

Muscles  
of the  
Thorax.

direction, which straight muscles could not have done so well.

**SCALENUS** arises from the transverse processes of the second, third, fourth, fifth and sixth cervical Vertebrae. It is inserted in three parts, (being thus divided for the transmission of the subclavian vessels) into the two uppermost ribs. This muscle may bend the neck, but its chief use is to support its upper ribs, which is necessary to determine the contraction of the intercostal muscles that way, and a ligament could not have done this, because of the various positions that the neck and back are liable to.

**SERRATUS SUPERIOR POSTICUS**, arises with a thin tendon inseparable from the Rhomboides, from the spinal process of the inferior cervical Vertebra, and the three superior of the Thorax, and is inserted into the second, third, and fourth ribs, immediately beyond their bendings; this, with the Scalenus, sustains the upper ribs, that they might not be pull'd downward, by the depressors of the ribs in expiration, as the lower ribs are upward in inspiration.

**SERRATUS INFERIOR POSTICUS**, arises with a broad tendon (inseparable from that of the Latissimus Dorsi) from the spinal processes of three superior Vertebrae of the loyns, and two inferior of the Thorax, and is inserted into the tenth rib, but chiefly the ninth and eleventh. It pulls down the ribs in expiration.

**INTERCOSTALES**, are eleven pair on each side, in the interstices of the ribs; from their situations distinguished into external and internal; they

they all arise from the under edge of each rib, and are inserted into the upper edge of the rib below. The external are largest backward, having their first beginnings from the transverse processes of the *Vertebræ* like distinct muscles, which some call *Levatores Costarum*. The internal run all from above obliquely backward; being thickest forward, and thinnest toward the spine. These are also continued betwixt the cartilages of the *Sternum*, with fibres perpendicular to the *Cartilages*; and between the cartilages of the lowest ribs, they are inseparable from the *Obliquus Ascendens Abdominis*. These muscles by drawing the ribs nearer to each other, pull them all upward, (they being sustained at the top by the *Scalenus* and *Serratus Superior Posticus*) and dilate the *Thorax*. To these Mr. Cowper adds some fleshy fibres, which run from one rib over a second to a third, near the spine, which are *Levatores Costarum*.

*TRIANGULARIS STERNI*, arises internally from the *Cartilago Ensiformis*, and the lower edge of the *Os Pectoris*, and is inserted into the end of the third, fourth, fifth and sixth ribs. This pulls the ribs to the bone of the *Sternum*, and thereby bends its cartilages in expiration.

*DIAPHRAGMA*, arises on the right side by a process from three lumbal *Vertebræ*, and one of the *Thorax*; and on the left, from the one superior of the loyns, and inferior of the *Thorax*; (this last part being less to give way to the great artery) and is inserted into the lower part of the *Sternum* and the five inferior ribs. The middle

of this muscle is a flat tendon, from whence the fleshy fibres begin, and are distributed, like Radii, from a center to a circumference. When this muscle acts alone, it constricts the Thorax, and pulls the ribs downward, and approaches toward a plain; which action is generally performed to promote the ejection of the Fæces. In large inspirations, when the intercostals lift up the ribs to widen the Thorax, this muscle acts enough to bring it self toward a plain without overcoming the force of the intercostals; by which means the breast is at once widened and lengthened: When it acts with the abdominal muscles it draws the ribs nearer together, and constricts the Thorax, and the superior force of the abdominal muscles thrusting the parts of the lower belly against it, it becomes at the same time convex upward, and shortens the Thorax, which occasions the largest expirations; or acting alternately with the abdominal muscles only, a more moderate inspiration and expiration is made by shortening and lengthening the Thorax only, which is what we chiefly do when lying down; or acting alternately with the intercostals only, a moderate expiration and inspiration is caused by the widening and narrowing the breast, which is what we are most prone to in an erect position, the muscles of the Abdomen, at such times, being employed in supporting the parts contained in the Abdomen. And though these motions of the ribs require at any one time but very little force, the air within the Thorax balancing that without; yet that these muscles whose motions are essential to life may be  
never

never weary, the inspirators in most men have force sufficient to raise mercury in a tube four or five and twenty inches, in an erect posture, and the expirators six or seven; the first of which will require about four thousand pound force in most men, and the other proportional. But I imagine, that lying down, these proportions will differ by the weight of the parts contained in the Abdomen. In all the bodies I have dissected, I have found the diaphragm convex upward, which gave me occasion to think, that all animals died in expiration, till the forementioned experiment discovered, that the muscles of inspiration were stronger than those of expiration; which led me to make the following experiment. I cut the wind-pipe of a dog, and having a string ready fixed, I put a cork into it, and tyed it fast instantly after inspiration; upon which I observed, that the diaphragm, and the other muscles of inspiration and expiration were alternately contracted, and distended for some time; but when he was dead, the abdominal muscles were in a state of contraction, the ribs were elevated to dilate the Thorax, and the diaphragm was convex upward; this experiment also shews, that the diaphragm is not a muscle of equal force either to the depressors or elevators of the ribs, it neither hindering the elevators from raising the breast; nor the depressors from thrusting it upward, by compressing the parts contained in the Abdomen, though the breast was full of air.



Muscles  
of the  
loins,  
back and  
neck.

SACER SACROLUMBALIS, LONGISSIMUS DORSI, and SEMISPINALIS, are all that portion of flesh betwixt the Os Sacrum and the neck, which, seeing there is no membrane to distinguish it into several muscles, and that it is all employed in the same actions, I shall give it the name of Extensor Dorsi & Lumborum, and describe it all as one muscle.

EXTENSOR DORSI & LUMBORUM, arises from the upper part of the Os Sacrum, the spine of the Os Ilium, the back-part of the lowermost Vertebrae of the loins, and remarkably from those strong tendons which appear on their out-sides. That part of this muscle which is known by the name of Sacrolumbalis is inserted into all the ribs near their articulations, with the transverse processes of the Vertebrae, and into the transverse process of the last Vertebra of the neck; besides, as this passes over the ribs, it receives an origin from every rib, in a manner that cannot well be described: The portions of this muscle which arise from the ribs, and are inserted into other ribs above will necessarily draw the back-part of the ribs nearer together, which must always be done as the back extends, and independent of other actions of the Thorax. The next portion of this muscle, called Longissimus Dorsi, is inserted into all the transverse processes of the Vertebrae of the back, and partly into the ribs, and the uppermost transverse processes of the Vertebrae of the loins; and the upper end of it is neither very distinct from the Complexus of the head, nor Spinalis of the neck. The rest of this muscle,

muscle, known by the names of Semispinalis, Sacer, &c. arises also from all the transverse and oblique processes of the loins and back; every portion, except the lowermost, passing over five joints, is inserted into the spinal process of the sixth Vertebra above its origin, all the way up the back, and at the neck commences Transversalis Colli: This passing of each portion of a muscle over a few joints, distributes their force equally enough among all these joints, without the fibres being directed more obliquely than those of penniform muscles; but the neck and loins not having sufficient provision of this sort, there are small muscles between their processes, which though they are of little importance for the motions of those parts, yet are sufficient to distribute the force of larger muscles equally among those joints; and besides the uses of the Extensor Dorsi & Lumborum, which its name implies, it, and its fellow, alternately raise the hips in walking, which any one may feel by laying his hand upon his back.

**QUADRATUS LUMBORUM**, arises from the upper part of the spine of the Ilium, and is inserted into all the transverse processes of the four uppermost lumbar Vertebrae. This, with its fellow, acting alternately, assist the last mentioned muscle in raising the *Ossa Innominata* in progression: Or each acting singly, while the lower limbs are not moved, inclines the body to one side.

**INTERTRANSVERSALES LUMBORUM**, are small muscles seated between all the transverse  
pro-

processes of the *Vertebræ Lumborum*, to bring them nearer together.

**Psoas Parvus**, arises laterally from the body of the first lumbal *Vertebra*, and the lowest of the back, and soon becoming a small tendon, is inserted into the *Os Pubis* near the *Ilium*. It either assists in bending the loins forward, or raising the *Os Innominatum* in progressive motions. This muscle is often wanting.

Muscles  
of the  
thigh.

**Psoas Magnus**, arises laterally from the bodies and transverse processes of the four superior *Vertebræ* of the loins, and the last of the back, and is inserted with the following muscle into the lesser *Trochanter*. This bends the thigh, and when the *Psoas Parvus* is wanting this is larger.

**Iliacus Internus**, arises from the concave part of the *Ilium*, and from its lower edge, and passing over the *Ilium* near the *Os Pubis*, joins the former muscle, and is inserted with it, to be employed in the same action.

**Pectineus**, arises from the *Os Pubis* or *Pectinis*, near the joining of that bone with its fellow, and is inserted into the *Linea Aspera* of the thigh-bone, four fingers breadth below the lesser *Trochanter*. This bends the Thigh and turns the toes outward.

**Triceps Femoris**, the two lesser heads of this muscle arise under the *Pectineus*, and the third from the inferior edges and back-part of the *Os Pubis* and *Ischium*, and is inserted into the whole length of the *Linea Aspera* and the inner *Apophysis* of the *Os Femoris*. This also bends the thigh and turns the toes outward. When the thigh-

thigh-bone is moved in a plain, which cuts at right angles a plain that passes through the Axis of either head of the last muscle, that head rising lower than the center of motion of the hip-joint, it will equally assist both the flexors and extensors, and that most when the bone has been moved most backward or forward; and as either of these heads lie more or less out of the said plain, they will give greater assistance to that motion which is made on the side of the said plain, contrary to their situation, and less on the same side. This mechanism is frequently made use of to make one muscle serve different actions; but I have only explained it in this instance, because it is the most considerable one that I know.

GLUTEUS MAXIMUS, arises from the back-part of the spine of the Ilium, and the Dorsum Ilii, and side of the Os Coccygis and Sacrum, and a ligament extended between these bones, and from a thin Fascia spread over that part of the following muscle, which this does not cover, and is inserted by a strong tendon into the upper part of the Linea Aspera of the thigh-bone, and also into the flat tendon of the Fascialis muscle, which insertion into, or connection with, that tendon raises this muscle farther from the center of motion and encreases its strength. This extends the thigh, and both these together being contracted, occasionally assist the Levatores Ani in supporting the Anus. The breadth of the origin and insertion of this muscle, is very observable, for by that means though it is the largest muscle in the body, it is nevertheless right-lined without one fibre



fibre compressing another any more than in penniform muscles.

**GLUTEUS MEDIUS**, arises from all the anterior part of the spina and Dorsum Ilii, and under part of the last mentioned muscle, and is inserted into the upper part of the great Trochanter of the thigh-bone. This extends the thigh outward.

**GLUTEUS MINIMUS**, arises entirely under the former, from the Dorsum Ilii, and is inserted into the upper and anterior part of the great Trochanter and neck of the thigh-bone to extend the thigh.

**PYRIFORMIS**, arises internally from the inside of the Os Sacrum, and growing in more than half its progress into a round tendon, is inserted into the upper part of the sinus at the root of the great Trochanter. This assists somewhat in extending the thigh, but more in turning it outward.

**QUADRATUS FEMORIS**, arises from the obtuse process of the Ischium, and is inserted into the upper part of the Linea Aspera of the thigh-bone, between the two Trochanters. This draws the thigh inward, and directs the toes outward.

**OBTURATOR INTERNUS**, or **MARSUPIALIS**, arises generally from a strong membrane or ligament, which fills up the hole of the Os Innominatum, and from the circumambient bone; thence passing over a channel in the Ischium betwixt its two processes, it receives from them two other portions, which are a sort of Marsupium; and



and is inserted into the Sinus of the great Trochanter. This turns the thigh outward.

**OBTURATOR EXTERNUS**, arises opposite to the former, from the outside of the Os Innominatum, and is inserted into the Sinus of the great Trochanter. This also turns the thigh outward. These four last mentioned muscles acting with the extensors, prevent their turning the toes inward, and in stepping forwards are continually acting to turn the toes outwards; for though the toes are placed perpendicular to the front of the body, in taking a long step, these muscles bring them perpendicular to the side of the body; and as these direct, the same extensors will turn the thigh either outward or backward, with their full force.

**FASCIALIS** or **MEMBRANOSUS**, arises from the forepart of the spine of the Ilium, and in about five inches progress becomes a flat tendon or Fascia, which is joined by a considerable detachment from the tendon of the Gluteus Maximus, and from the Linea Aspera of the thigh-bone, and then covering in an especial manner the Vastus Externus is inserted at the top of the Tibia and Fibula, and then proceeds to join the Fascia, which covers the upper part of the muscles situate on the outside of the Tibia, and from which a great part of the fibres of those muscles arise. About the middle of the leg it grows loose, and is so continued to the top of the foot, being connected there and at the lower part of the leg, to the ligaments which tie down the tendons; this tendon, where it covers the Vastus

Muscles  
of the  
Tibia.

Exter-

**Externus**, receives additional transverse fibres, which run round the thigh, but are most conspicuous on the outside. This draws the thigh outward, and passing over the knee forwarder than its Axis of motion, it will help to extend that joint.

**GRACILIS**, arises from the Os Pubis close to the Penis, and is inserted into the Tibia four or five fingers breadth below the knee. This draws the thigh inward, and passing over the knee behind its Axis of motion, it will help to bend it.

**SARTORIUS**, arises from the fore-part of the spine of the Ilium, and thence descending obliquely to the inside of the Tibia is there inserted four or five fingers breadth below the joint. This at once helps to bend both the thigh and leg, (particularly the thigh) at very long levers: it directly helps to lift up the leg in walking up stairs, or laying the legs across like taylor's.

**SEMITENDINOSUS**, arises from the obtuse process of the Ischium, and growing a round tendon in somewhat more than half its progress, is inserted near the former muscles into the Tibia; it helps to extend the thigh and bend the Tibia.

**SEMIMEMBRANOSUS**, arises by a flat tendon like a membrane from the obtuse process of the Ischium, and being continued tendinous betwixt the bellies of the last mentioned and following muscles, and then growing fleshy, becomes again tendinous above the joint, and is inserted nearer the joint than the former muscle for the same use.

**THESE**

THESE two make the internal hamstring, and arising and inserting so near together, they might have been one muscle, but their fibres would have been near twice as long, which would have given a motion near twice as quick, but not so strong, unless it had been inserted at a distance from the joint it moves proportionable to its length, which could not well be, therefore they are made two muscles of a number of fibres nearly equal to what one could have been, and are inserted at distances from the Axis of motion of the knee, proportional to the different lengths of their fibres in the directions of their Axes.

BICEPS TIBIÆ, the first head arises in common with the two preceding muscles, from the obtuse process of the Ischium: the second from the lower part of the Linea Aspera of the thigh-bone; this soon joins the former, and is inserted with it into the upper part of the Fibula to bend the leg, and the first head also extends the thigh. The tendon of this muscle makes the external hamstring, when the knee is bent, and when we sit down, the Biceps will turn the leg and toes outward, and the Semitendinosus and Semimembranosus will turn them inward.

POPLITEUS, arises from the outer Apophysis of the Os Femoris, and thence running obliquely inward, is inserted into the Tibia immediately below its head. This assists the flexors, and draws the Tibia toward the outer Apophysis of the thigh-bone.

RECTUS TIBIÆ, arises with a tendon from the upper part of the Acetabulum of the Os In-

I nomi-

## *Of the Muscles.*

nomina<sup>tum</sup>, and by another tendon (which is a sort of ligament to this) from a Processus Innomi<sup>natus</sup> of the Illium below its spine forward, and is inserted together with the three following muscles into the Patella. It bends the thigh, and extends the Tibia.

**VASTUS EXTERNUS**, arises from the anterior part of the great Trochanter and upper part of the Linea Aspera of the thigh bone, and is inserted into the upper and external part of the Patella. It extends the Tibia.

**VASTUS INTERNUS**, arises from the inner and lower part of the Linea Aspera, and is inserted into the upper and inner part of the Patella, to extend the Tibia; and the fibres of this muscle being oblique, it keeps the Patella in its place, the other muscles lying in the direction of the Os Femoris, which makes an obtuse angle with the Tibia, they would alone be liable to draw the Patella outward. This contrivance is most obvious in those whose knees bend most inward.

**CRUREUS**, arises between the two last below the Rectus, from all the convex part of the Os Femoris, and is inserted in like manner into the Patella; the Patella being tied down by a strong ligament to the Tibia. These three last muscles extend the Tibia only, and might very properly be called, Extensor Tibiæ Triceps.

WHEN the Patella is so broke transverse that the part into which the muscles are inserted is distinctly separated from that by which the ligament is fixed, the fracture can never be well cured,



red, because the muscles will keep the parts asunder; but when the fracture is otherwise, it admits of a better cure.

**GASTEROGNEMIUS**, arises by two small beginnings above the back-part of the Apophyses of the Os Femoris, which soon becoming large bellies unite, and then become a flat tendon which joins the following muscles to be inserted into the Os Calcis. The two parts of this muscle, are by some writers distinguished into two muscles. Its use is to extend the Tarsus and bend the knee.

Muscles  
of the  
Tarsus

**PLANTARIS**, arises under the outer beginning of the last named muscle, from the external Apophysis of the Os Femoris, and soon becoming a small tendon, is so continued betwixt the foregoing and subsequent muscles, and is inserted with them. It bends the knee and extends the Tarsus. Authors derive the tendinous expansion on the bottom of the foot from the tendon of this muscle; but seeing the expansion is much more than this tendon could make, and that this tendon can be traced no farther than the Os Calcis, and that the expansion is as large when the muscle is wanting, which is not seldom, I cannot be of that opinion.

**GASTEROGNEMIUS INTERNUS**, arises from the upper part of the Tibia, and one third of the Fibula below the Popliteus, and is inserted with the two foregoing muscles by a strong tendon into the upper and back-part of the Os Calcis. This muscle only extends the Tarsus.



*Of the Muscles.*

**TIBIALIS ANTICUS**, arises from the upper and exterior part of the Tibia, and is inserted laterally into the Os Cuneiforme Majus of the Tarsus, and by a small portion of its tendon into the metacarpal bone of the great toe. This bends and turns the Tarsus inward.

**TIBIALIS POSTICUS**, arises first by a small beginning from the upper part of the Tibia between that bone and the Fibula, then passing between the bones through a perforation in the transverse ligament which connects those bones, it takes other beginnings from the upper and middle part of the Tibia, and from the middle of the Fibula, and the ligament betwixt the Tibia and Fibula; then growing a round tendon, passes under the inner angle, and is inserted into the lower part of the Os Naviculare, and into the Os Cuneiforme Majus. This extends and turns inward the Tarsus.

**PERONEUS LONGUS**, arises from the upper and outer part of the Fibula, and growing a tendon toward the lower part of this bone, passes under the outer angle, and the muscles situated on the bottom of the foot, and is inserted into the beginning of the metatarsal bone of the great toe, and the Os Cuneiforme next that bone. This turns the Tarsus outward, and directs the force of the other extensors of the Tarsus toward the ball of the great toe.

**PERONEUS BREVIS**, arises from the middle of the Fibula, under a part of the former, and growing tendinous, passes under the outer angle, and is inserted into the beginning of the upper  
part

part of the Os Metatarsi of the little toe, and sometimes bestows a small tendon on the little toe. Its use is to extend the Tarsus, and turn it outward.

THESE two last muscles riding over the lower end of the Fibula, are often the cause of a sprain in the outer angle, when they are vehemently exerted, to save a fall.

EXTENSOR POLLICIS LONGUS, arises from the upper and middle part of the Fibula and Ligamentum Transversale, and soon becoming a strong tendon, is inserted into the last bone of the great toe. This also bends the Tarsus with a much longer lever than it extends the toe. Muscles of the great toe.

EXTENSOR POLLICIS BREVIS, arises from the fore-part of the Os Calcis, and is inserted into the same place with the former.

FLEXOR POLLICIS LONGUS, arises from the Fibula, opposite to the Extensor Longus, and then passing under the inner angle, is inserted to the under side of the last bone of the great toe. This extends the Tarsus at a longer lever than it bends the toe.

FLEXOR BREVIS, and ADDUCTOR POLLICIS, are the same muscle, arising from the two lesser Offa Cuneiformia and Os Cuboides, and Calcis; they are inserted into the Offa Sesamoides, which are tied by a ligament to the first bone of the great toe, reckoning only two bones to the great toe. These muscles bend the great toe.

**ABDUCTOR POLLICIS**, arises pretty large from the inner and back-part of the Os Calcis, and by a smaller beginning from the Os Naviculare; thence passing forward contiguous to the Os Cuneiforme majus, passes by the external sesamoid bone of the great toe to its insertion into the first bone of the great toe. This muscle is less an Abductor than a Flexor Pollicis Pedis; it also very much helps to constrict the foot lengthways.

**TRANSVERSALIS, PEDIS**, arises from the lower end of the metatarsal bone of the toe next the least, and is inserted into the internal sesamoid bone. This is truly an Adductor of the great toe, and helps to keep the constriction of the bottom of the foot.

Muscles  
of the lesser  
toes.

**EXTENSOR DIGITORUM PEDIS LONGUS**, arises acute from the upper part of the Tibia, and from the upper and middle part of the Fibula and ligament between these bones; then dividing into five tendons, four of them are inserted into the second bone of each lesser toe, and the fifth into the beginning of the metatarsal bone of the least toe, and sometimes by a small tendon also into the little Toe. This last portion, for the most part is separate, from its beginning, and may be accounted a distinct muscle. The four first tendons only of this muscle extend the toes, but all five bend the Tarsus, and that with a longer lever than any of them bend a toe.

**EXTENSOR DIGITORUM BREVIS**, arises together with the Extensor Pollicis Brevis from the

the Os Calcis, and dividing into three small tendons is inserted into the second joint of the three toes next the great one. The long extensors of the toes serve not only to extend them, but also contribute to the bending of the ancle, which motions are usually performed together in progression; but the short extensors arising below the ancle, extend the toes only; and when the long extensors are employed for that action only, the extensors of the Tarsus must act at the same time, to prevent the bending of the ancle; this is the reason why the toes have need, tho' their motions are less, of more extensors than the fingers.

**FLEXOR BREVIS** or **PERFORATUS**, arises from the under and back-part of the Os Calcis, thence passing toward the four lesser toes, divides into four tendons, which are inserted into the beginning of the second bone of each of the lesser toes. These tendons are divided to let through the tendons of the following muscle.

**FLEXOR LONGUS** or **PERFORANS**, arises from the back-part of the Tibia, above the insertion of the Popliteus, and part of the Fibula; thence descending under the Os Calcis to the bottom of the foot becomes tendinous, which part crosses, and, in most bodies, communicates with the Flexor Longus Pollicis Pedis; then it divides into four tendons, which passing thro' those of the Flexor Brevis are inserted into the third bone of each of the four lesser toes. This muscle also extends the Tarsus. The second beginning of this muscle arises from the Os Calcis, and joins the



tendons where they divide. This portion only bends the toes; and seeing the Flexor Longus of the toes will, when it acts alone, extend the Tarsus as well as bend the toes, this portion (like the short extensors of the toes) seems purposely contrived to bend the toes alone.

LUMBRICALES, arise from the tendons of the Perforans, and are inserted into the first bone of each of the lesser toes, which they bend.

ABDUCTOR MINIMI DIGITI PEDIS, arises by the Perforatus from the Os Calcis, and being part of it inserted into the metacarpal bone of the least toe, it receives another beginning from the Os Cuboides, and is inserted into the first bone of the least toe, which it bends and pulls outward, and very much helps to constrict the bottom of the foot.

ABDUCTOR SECUNDUS MINIMI DIGITI, this arises under the former muscle from the metatarsal bone, and is inserted into the little toe.

INTEROSSEI, are seven muscles which lie like those of the hands, and arise like them from the metatarsal bones, and are inserted like them into the last joints of the four lesser toes, and being in their progress attached to the tendons which extend the second joints of the toes, they will extend both these joints. These muscles may be fitly divided into external and internal, the internal also bend the first joints, as do all the Interossei in the hand, but here the outer ones extend the first joints; and if we consider that the first of these muscles is analagous to the Abductor



etor Indicis of the hand, and that the Abductor Minimi is alike in both, we find that the muscles to move the fingers and lesser toes sideways are alike in number, though this motion of the toes is in a manner lost from the use of shoes. The muscles that bend or extend the last joints of the toes will also move the second and first, and those that move the second will also move the first. The same remark should have been made about the muscles of the fingers.

THOUGH a great many authors have thought it worth while to contend in many instances which shall be called the origin, and which the insertion of some muscles, whose ends have been both liable to be moved, yet none of them have considered, that every extensor of the thigh, Tibia, and Tarsus, has always had that end which is most moved called its origin, and the other its insertion; contrary to the rule which all have laid down to judge by.

THE number of the muscles cannot be adjusted, because anatomists are neither agreed about some of them, whether they should be counted muscles or not, nor of others how far they shall be divided; though in the main, they seem to think him the best anatomist who divides them most; for my own part, I am not for dividing them as far as they can be divided, but as far as is necessary to the knowledge of their uses.

## TABLE XI.

Figure 1. A rectilineal muscle.

Fig. 2. A single penniform muscle.

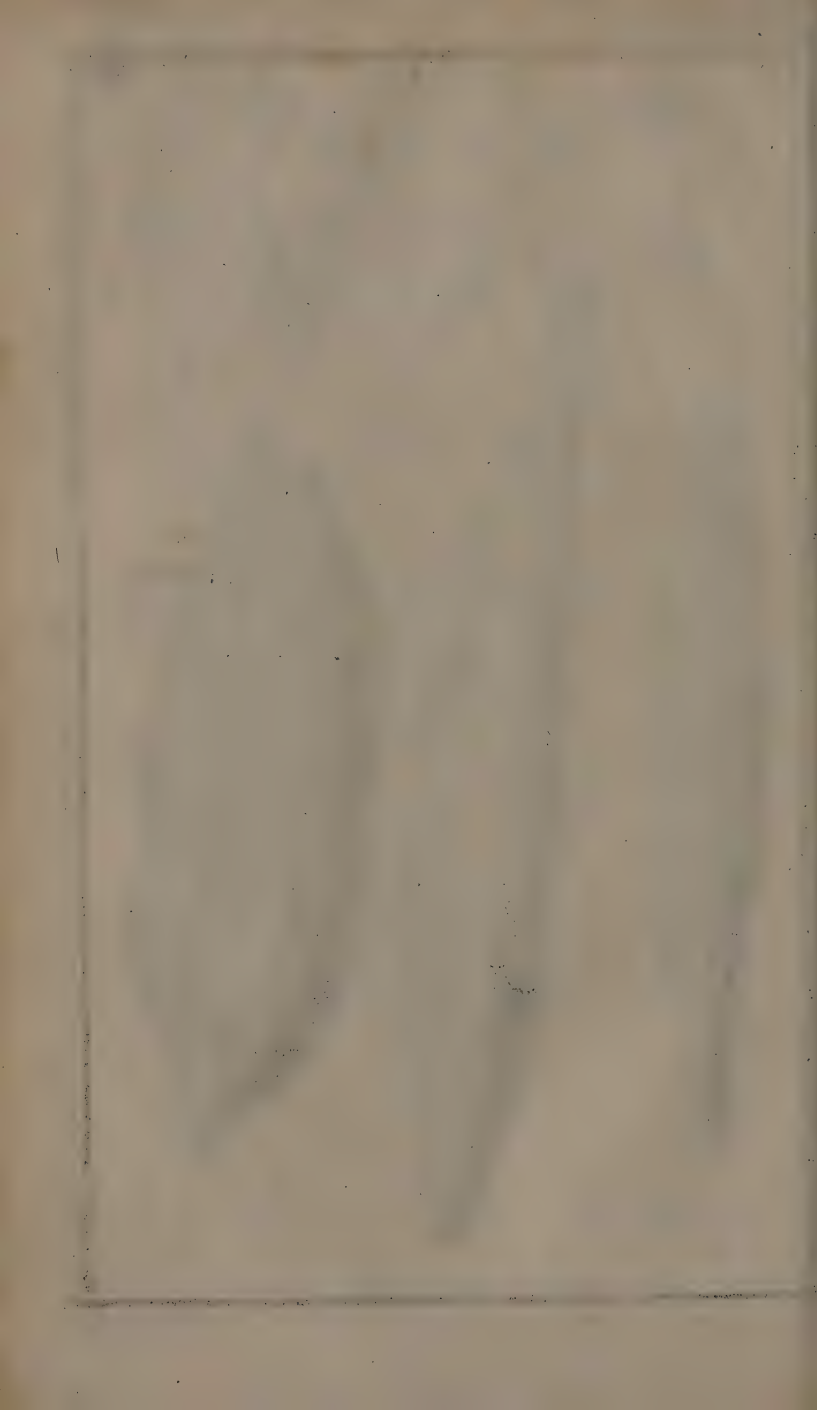
Fig. 3. A double penniform muscle.

Fig. 4. Is a scheme to explain the different properties of rectilineal and penniform muscles.

AB, are two pullies, about which the chord CDEFG is inflected. HI, are two equal weights, hung in a perpendicular direction at each end of this Chord. K, is another weight hung at E, the middle of that part of the chord which lies between the pullies. When the weight K, and the weights HI balance each other, the cosine of half the angle DEF, bears the same proportion to the Radius, as the weight K bears to the sum of the weights H and I: So that the weight K, must never be so great as the sum of the weights HI; and the less the weight K is, the greater will be the angle DEF, when the weights are in Equilibrio. Besides, if the weight K be raised directly upwards, the velocity wherewith the weight K is made to ascend, will be to the velocity wherewith each of the weights HI will descend, as the Radius to the cosine of half the angle DEF.

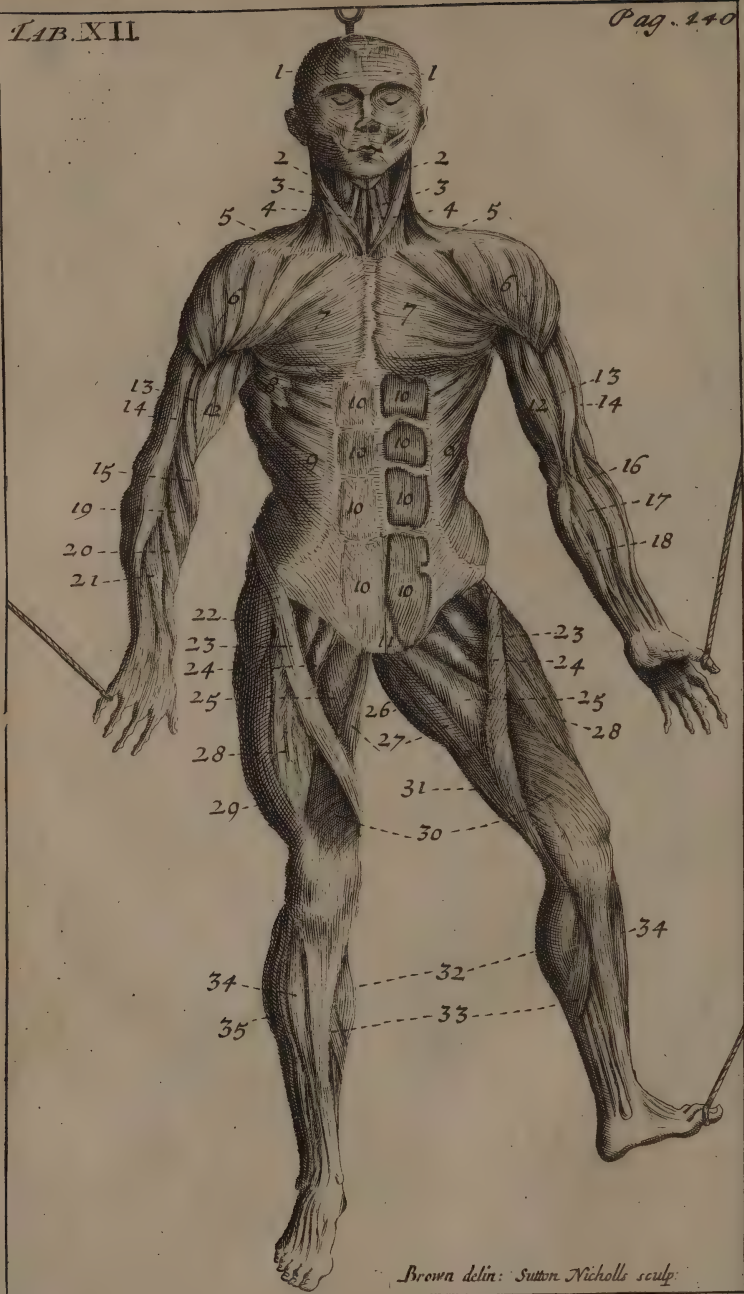
TABLE











## TABLE XII.

1. Frontalis.
2. Mastoideus.
3. Coracohyoideus.
4. Sternohyoideus.
5. A small part of the Trapezius.
6. Deltoides.
7. Pectoralis.
8. Part of the Serratus Major Anticus.
9. Obliquus Descendens Abdominis.
10. The portions of the Recti, the left being divested of its Fascia.
11. Pyramidales.
12. Biceps Cubiti Flexor.
13. Brachæus Flexor.
14. Triceps Extensor Cubiti.
- 15, 16. Supinator Radii Longus.
17. Flexor Carpi Radialis.
18. Flexor Carpi Ulnaris.
19. The first head of the Extensor Carpi Radialis.
20. The second head of the same muscle.
21. Extensor Digitorum Communis.
22. Fascialis or Membranosus.
23. Sartorius.
24. One head of the Triceps.
25. Pectineus.
26. The great head of the Triceps.
27. Gracilis.
28. Rectus.
29. Vastus Externus.
30. Vastus

- 30. Vastus Internus.
- 31. Semitendinosus.
- 32. Gasterocnemeus Externus.
- 33. Soleus, or Gasterocnemeus Internus.
- 34. Tibialis Anticus.
- 35. Tensor Pollicis Pedis Longus.



TABLE







## T A B L E XIII.

*Muscles of the Face.*

- A, Frontalis.
- B, Temporalis.
- C, Masseter.
- D, Orbicularis.
- E, Sphincter Oris.
- F, Elevator Labii Superioris Proprius.
- G, Elevator Labiorum Communis.
- H, Depressor Labiorum Communis.
- I, Depressor Labii Inferioris Proprius.
- K, Zygomaticus.
- L, Buccinator.
- M, *The right eye with its muscles.*
- N, Obliquus Superior.
- O, The Trochlea through which it passes.
- P, Obliquus Inferior.
- Q, Elevator Oculi.
- R, Depressor Oculi.
- S, Adductor Oculi.
- T, Abductor Oculi.
- U, The optick nerve.

*A view*

*A view of the posterior external muscles.*

1. Mastoideus.
2. Trapezius.
3. A very small part of the Elevator Scapulæ.
4. A very small part of the Rhomboides.
5. Deltoides.
6. Latissimus Dorsi.
7. Teres Major.
8. Infraspinalis Scapulæ.
9. Triceps extensor Cubiti.
10. Anconeus.
11. Extensor Carpi Ulnaris.
12. Extensor Carpi Radialis.
13. Extensor Digitorum Communis.
14. Extensor Primi Internodii Pollicis.
15. A very small part of the Supinator Radii Longus.
16. Gluteus Maximus.
17. Gluteus Medius.
18. Membranosus or Fascialis.
19. Gracilis.
20. The great head of the Triceps.
21. Semimembranosus.
22. Semitendinosus.
23. Biceps Tibiæ.
24. Vastus Externus.
25. Gasterocnemeus Externus.
26. Soleus, or Gasterocnemeus Internus.



# BOOK III.

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## CHAP. I.

*Of the external parts, and common integuments.*

**T**HE vulgar names of the external parts of the human body being sufficiently known for the description of any disease or operation; I shall only describe those which anatomists have given for the better understanding of the sub-contained parts.

THE hollow on the middle of the Thorax, under the breasts, is called Scrobiculus Cordis. The middle of the Abdomen for about three fingers breadth above and below the navel, is called Regio Umbilicalis. The middle part above this, Epigastrium. On each side of the Epigastrium, under the cartilages of the lower ribs, Hypochondrium; and from below the Regio Umbilicalis down to the Offa Iliæ, and Offa Pubis, Hypogastrium.

CUTI-

CUTICULA or SCARF-SKIN, is that thin insensible membrane which is raised by blisters in living bodies: It is extended over every part of the true skin, unless where the nails are. It appears to me in a microscope a very fine smooth membrane, only unequal where the Reticulum Mucosum adheres to it. Lewenhoeck and others, say, it appears scaly, and compute that a grain of sand of the hundredth part of an inch diameter, will cover two hundred and fifty of these scales, and that each scale has about five hundred pores; so that according to them, a grain of sand will cover 125000 pores, through which we perspire. Its use is to defend the true skin that it may not be exposed to pain from whatever it touches; and also to preserve it from wearing: It is thickest on those parts of the bottom of the foot which sustain the body; and in hands much used to labour, being so contrived as to grow the thicker, the more those parts are used.

BETWEEN this and the true skin, is a small quantity of slimy matter, which was supposed, by Malpighi, and others, to be contained in proper vessels, interwoven with one another, and therefore by them named Reticulum Mucosum. It is most considerable where the Cuticula is thickest, and is black, white, or dusky, such as is the complexion; the colour of this, and the Cuticula, being the only difference between Europeans, and Africans or Indians, the fibres of the true skin being white in all men; but the florid colour of the cheeks, is owing to the blood in the minute vessels of the skin, as that in the lips to the vessels

vessels in the muscular flesh; for the Cuticula (as I imagine) being made of excrementitious matter, has no blood vessels.

CUTIS or TRUE SKIN, is a very compact, strong, and sensible membrane extended over all the other parts of the body, having nerves terminating so plentifully in all its superficies, for the sense of touching, that the finest pointed instrument can prick no where without touching some of them. These nerves are said by Malpighi, and others, who have examined them carefully, to terminate in small pyramidal Papillæ; nevertheless to me it seems, that a plain superficies of the skin (I do not mean mathematically plain) is much fitter and more agreeable to what we experience of this sensation; for a plain superficies exposing all the nerves alike, I think would give a more equal sensation, while nerves ending in a pyramidal Papilla would be exceeding sensible at the Vertex of that Papilla; and those at the sides and round the base, which would be far the greatest part, would be the least useful.

GLANDULÆ MILIARES, are small bodies like millet seeds, seated immediately under the skin in the Axillas; and are said to have been found under all other parts of the skin, where they have been looked for with microscopes: These glands are supposed to separate sweat; which fluid was formerly thought to be only the Materia Perspirabilis flowing in a greater quantity, and condensed; but Sanctorius has assured us, that it is not so, and that more of the Materia Perspirabilis is separated in equal times than of

K

sweat;



sweat; of the former, he says, usually fifty two ounces a day in Italy, where his experiments were made, and of the latter not near so much in the most profuse sweats; which, I think, favours the opinion of the existence of these glands, unless the sweat being once condensed upon the skin, prevents a greater effusion of that matter. Now that the whole body, every part of which is surely perspirable (or how else could extravasated blood or matter ever be dissipated, unless it could be absorbed into the vessels, which seems impossible, seeing that the fluids which are in motion in the vessels must out-balance those which are extravasated) should perspire fifty two ounces in a natural day, is not at all incredible. But that these glands, if there are such under all the skin, should be able to make so large secretions, appear not very probable to me, however I wish those who have more leisure and judgment than myself, would examine this more nicely, because so much theory of cutaneous diseases depends upon it.

MEMBRANA ADIPOSITA, is all that membrane immediately under the skin, which contains the fat in cells; it is thickest on the Abdomen and buttocks, and thinnest near the extremities; and where the muscles adhere to the skin, and on the Penis, none. It contributes to keep the inner parts warm, and by filling the interstices of the muscles, renders the surface of the body smooth and beautiful, and may perhaps serve to lubricate their surfaces, and whether the decrease of fat which often follows labour or sickness, proceeds

ceeds from its being reassumed into the blood vessels, or whether it is constantly perspiring through the skin, and the lessening of its quantity is from the want of a supply equal to its consumption, is with me a matter of doubt, though the former opinion I know generally prevails.

MAMMÆ, the BREASTS, seem to be of the same structure in both sexes, but largest in women. Each breast is a conglomerate gland to separate milk, seated in the Membrana Adiposa, with its excretory ducts, (which are capable of very great distention,) tending toward the nipple, which as they approach, they unite, and make but a few ducts at their exit. There are to be met with in authors, instances sufficiently attested of mens giving suck, when they have been excited by a vehement desire of doing it: And it is a common observation, that milk will flow out of the breasts of new-born children, both male and female.

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## C H A P. II.

### *Of the Membranes in general.*

EVERY distinct part of the body is covered, and every cavity is lined with a single membrane, whose thickness and strength is as the bulk of the part it belongs to, and as the friction to which it is naturally exposed.

THOSE membranes that contain distinct parts, keep the parts they contain together, and render their surfaces smooth, and less subject to be lacerated by the actions of the body. And those which line cavities, serve to render the cavities smooth, and fit for the parts they contain to move against.

THE membranes of all the cavities that contain solid parts, are studded with glands, or are provided with vessels, which separate a Mucus to make the parts contained move glibly against one another, and not grow together. And those cavities which are exposed to the air, as the nose, ears, mouth, and Trachea Arteria, have their membranes beset with glands, which separate matter to defend them from the outer air. Those membranes that have proper names, and deserve a particular description, will be treated of in their proper places.

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### C H A P. III.

#### *Of the salivary glands.*

PAROTIS OR MAXILLARIS SUPERIOR, is the largest of the salivary glands; it is situated behind the lower jaw, under the ear; its excretory duct passes over the upper part of the Masseter muscle, and enters the mouth through the Buccinator. This gland has its Saliva promoted by the motions of the lower jaw. Its duct

duct passes over the tendinous part of the Masseter muscle that it may not be compressed by that muscle, which would obstruct the Saliva in it, though it is frequently said that it passes over that muscle that it may be compressed by it to promote the Saliva. In sheep and calves, their jaws being long, this muscle is inserted far from the center of motion, that the end of the jaw may be moved with sufficient strength; and that distant insertion requiring a greater length of muscle, that its motion may be quick enough, no part of this muscle could be allowed to be tendinous; therefore it seems, to avoid the inconvenience of compression from the muscle, the duct in those animals goes quite round the lower end of it. When this duct is divided by an external wound, the Saliva will flow out on the cheek, unless a convenient perforation be made into the mouth, and then the external wound may be healed. I have seen two patients with this gland ulcerated, from which there was a constant effusion of Saliva, 'till the greatest part of the gland was consumed with red mercury precipitate; and then it healed with little trouble. Hildanus mentions the same case, which for two years had been under the care of a surgeon without success; and was at last cured by the application of an actual cautery.

MAXILLARIS INFERIOR, is situate between the lower jaw, and the tendon of the digastrick muscle; its duct passes under the Musculus Mylohyoideus, and enters the mouth under the tongue, near the Dentes Incisorii. I was at the opening of a woman who was suffocated by a

## *Of the salivary Glands.*

tumour which begun in this gland; it extended it self from the Sternum to the parotid gland on one side in six weeks time, and in nine weeks killed her. It was a true Schirrus, and weighed twenty six ounces. In a man which I dissected, I found a quantity of Pus near this gland, and a bundle of matter not unlike hair as large as a hen's egg.

**SUBLINGUALIS**, is a small gland situated under the tongue, between the jaw and the Cera-  
taglossus muscle. In a calf I found several ducts of this gland filled by an injection into the duct of the submaxillary gland; but Morgagni and others affirm that the ducts of this gland enter the mouth directly from the gland in several Places near the grinding teeth.

**TONSILLA**, is a globular gland about the bigness of a hazel-nut, situate upon the Pterygoideus Internus muscle, between the root of the tongue and the Uvula. It has no duct continued from it, but empties all its small ducts into a Sinus of its own, which Sinus, when the gland is inflamed, may easily be mistaken for an ulcer. This gland with its fellow, direct the masticated aliment into the Pharynx; and also serve for the Uvula to shut down upon when we breathe through the nose. They are compressed by the tongue and the aliment, when the former raises the latter over its root, and thereby opportunely emit their Saliva to lubricate the food for its easier descent through the Pharynx. A schirrous tumour of either of these glands is a common disease, and it admits of no remedy but extirpation



pation; yet it must not be performed upon the whole gland, but so much of it as is become supernaturally eminent; because that would be dangerous as well as difficult. The best way of extirpating these glands is, I think, by ligature: If the gland is small at its basis, the ligature may be tied round it, which I have easily performed by fixing the ligature to the end of a probe, which I bent, and so drew it round the gland, and tied it; about five days after this ligature growing loose, I put on another in the same manner, and then in a few days the gland dropped off: but meeting with another case of this kind, where the basis of the gland was too large to tie, I contrived an Instrument like a crooked needle set in a handle with an eye near the point; I thrust this instrument, with a ligature in it through the bottom of the gland, and then taking hold of the ligature with a hook, I drew back the instrument; then drawing the double ligature forwards, I divided it, and tied one part above and the other below, in the same manner that I did to extirpate part of the Omentum in the cure of an Hernia: See the plate at the latter end of this book, and this succeeded as well as the former. I once saw them totally destroyed by venereal ulcers, and the Uvula, which was whole, having nothing to shut against, the patient snuffled almost as much as if the Uvula had been gone.

PRESSURE upon the surface of a gland very much promoting the secretion that is made in it, these glands are so seated as to be pressed by the

lower jaw, and its muscles, which will be chiefly at the time when their fluid is wanted; and the force with which the jaw must be moved, being as the driness and hardness of the food masticated, the secretion from the glands depending very much upon that force; it will also be in proportion to the driness and hardness of that food which is necessary; for all food, being to be reduced to a pulp, by being mixed with Saliva before it can be swallowed fit for digestion, the drier and harder foods needing more of this matter, will from this mechanism be supplied with more than moister foods in about that proportion in which they are drier and harder; and the drier foods needing more Saliva than moister, is the reason why we can eat less and digest less of these than those. What quantity of Saliva these glands can separate from the blood, in a given time, will be hard to determine, but in eating of dry bread it cannot be less than the weight of bread; and many men, in a little time, can eat more dry bread than twice the size of all these glands; and some men, that are not used to smoaking, can spit half a pint in the smoaking one pipe of tobacco; and some men in a salivation, have spit, for days or weeks together, a gallon in four and twenty hours; and, yet I believe, all these glands put together, do not weigh more than four ounces.

THE membrane which lines the mouth and palate, and covers the tongue, is every where beset with small glands, to afford Saliva in all parts of the mouth to keep it moist; for those more remote

mote are chiefly concerned in time of mastication. These small glands have names given them according to their respective situation, as Buccales, Labiales, Linguales, Fauciales, Palatinæ, Gingivarum, and Uvulares.

A GLAND is chiefly composed of a convolution of one or more arteries of a considerable length, from whose sides arise vast numbers of excretory ducts, as the lacteals arise from the guts, and for the same reason; for the passages into the excretory ducts of a gland, being such as that only one sort of fluid may pass into them, the want of largeness is compensated by their number; and in a great length of an artery, as in the guts those proper fluids which escape one duct may pass into another; and from what has been said, it does not appear but that excretory ducts may arise from the vessels that form membranes without being convolved at all. And this way I imagine secretions are made from all the membranes that line cavities, and some others. There also arise from these arteries lymphatic vessels, whose use seems to be to take off the thinnest part of the blood, where a thick fluid is to be secreted, seeing they are found in greatest plenty in such glands as separate the thickest fluids, as in the testicles and liver; and it is observable that where the thickest secretions are made, the velocity of the blood is the least, as if it was contrived to give those seemingly more tenacious parts more time to separate from the blood. The arteries that compose different glands are convolved in different manners, but whether or no their different

rent

rent secretions depend upon that, I doubt will be difficult to discover. The excretory ducts arise from the arteries, and unite in their progress as the roots of trees do from the earth, and as different trees, plants, fruits, and even different minerals, in their growing, often derive their distinct proper juices from the same kind of earth; so the excretory ducts in different glands, separate from the same blood their different juices: But what these different secretions depend upon, whether the structure of the parts or different attractions, are what we have no certainty about, though this subject has employed several of the best writers. For my own part, from the great simplicity and uniformity usually seen in nature's works, I am most inclined to think different secretions arise from different attractions, seeing that in plants and mineral there seems to be no other way.

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## C H A P. IV.

### *Of the Peritoneum, Omentum, Ductus Alimentalis and Mesentery.*

**P**ERITONEUM, is a membrane which lines the whole cavity of the Abdomen. It contains the liver, spleen, omentum, stomach, guts and mesentery, with all their vessels and glands; the upper part of it is no other than the proper membrane of the diaphragm, and, but for com-



pliance with custom, there is no more reason for calling that, part of the Peritoneum, than there is for calling the membrane on the other side of the diaphragm part of the Pleura or Mediastinum. The fore part next the muscles of the Abdomen, and their tendons may be divided into two Laminæ, yet I think anatomists in describing the duplicature or Laminæ of the Peritoneum have not always meant this division, but have taken the tendons of the transverse muscles for the outer Lamina, and considered the other as one membrane, seeing that it is between these tendons and the Peritoneum that the water is usually found in that kind of dropsy which is called the dropsy in the duplicature of the Peritoneum. Upon the loins the inner surface only is smooth, and the outer part a sort of loose Membrana Adiposa, in which are contained the Aorta, Vena Cava, Vasa Spermatica, and Pancreas, with other parts of less note. The middle of the Peritoneum upon the loins is joined to the mesentery in such a manner, as makes some account it a production of the Peritoneum, and some part of the external membrane of the Duodenum, becoming one membrane with the inner or smooth Lamina of the Peritoneum, and part of the Rectum is covered in the same manner; but the kidneys and bladder of urine are contained in a distinct duplicature of this membrane. The dropsy of the Peritoneum, may be distinguished, by being least prominent about the navel, for there the tendons and the Peritoneum will not separate; and the water, in those that I have dissected, had made the parts  
where



where it was contained as foul as any ulcer ; therefore none of them I presume could have been cured by operation.

FOR the Umbilical vessels, see chap. of the Fœtus. For the Proceſſus Vaginals, chap. of the parts of generation in men.

OMENTUM, or CAWL, is a fine membrane larded with fat, somewhat like net-work: It is situated on the surface of the small guts, and resembles an apron tuck'd up; its outer or upper part, named *Ala Superior*, is connected to the bottom of the stomach, the spleen, and part of the *Intestinum Duodenum*; and thence descending a little lower than the navel, is reflected and tyed to the *Intestinum Colon*, the spleen, and part of the *Duodenum*: This last part is called *Ala Inferior*; and the space between the *Alæ* is named *Bursa*. This cavity is very distinct in most brutes, but seldom so in men. Sometimes both *Alæ* are tied to the liver, and, in diseased bodies, to the *Peritoneum*. Its use is, to lubricate the guts, that they may the better perform their peristaltick motion. *Malpighi* describes adipose ducts in this membrane to carry the fat from the cells into the *Vena Portarum*, and thinks it a necessary ingredient in the bile. In dropſies of the Abdomen, and in persons who from any other cause have died tabid, it is generally rotten and decayed; and sometimes the guts in these cases adhere to one another: But whether these adhesions proceed from the *Omentum's* ceasing to perform its office, or from the peristaltick motion of the guts, being long discontinued through absti-

abstinence, or both, I cannot determine. I have seen one instance, from dissection, of a very large rupture of the Omentum, or Epiploon, into the groin, together with one of the guts; the rupture of the Omentum, is called by authors Epiplocele.

DUCTUS ALIMENTALIS, is the Œsophagus, stomach and guts, viz. Duodenum, Jejunum, Ileum, Colon, Cæcum or Appendicula Vermiformis, and Rectum.

ŒSOPHAGUS or gullet, is the beginning of the alimentary duct; its upper part is wide and open spread behind the tongue to receive the masticated aliment; it begins from the basis of the scull near the Processus Pterygoïdes of the sphenoidal bone, then descending becomes round, and is called Vaginalis Gulæ; it runs from the tongue close to the spine, under the left Subclavian blood vessels, into and through the Thorax on the left side, then piercing the diaphragm, it immediately enters the stomach. It is composed of a thin outer coat, which is no more than a proper membrane to the middle or muscular coat. The middle coat is composed of longitudinal and circular muscular fibres, but chiefly circular, abundantly thicker than the same coat in the guts; because this has no foreign power to assist it, as the guts have, and because it is necessary the food should make a shorter stay here than there. The inner coat, is a pretty smooth membrane, beset with many glands, which secrete a mucilaginous matter, to defend this membrane, and render the descent of the aliment easy.

VENTR-

Tab. xiv.  
6.

VENTRICULUS, the stomach, is situated under the left side of the diaphragm, its left side touching the spleen, and its right is covered by the thin edge of the liver; its figure nearly resembles the pouch of a bag-pipe, its left end being most capacious, the upper side concave and the lower convex; it has two orifices, both on its upper part; the left (through which the aliment passes into the stomach) is named Cardia; and the right (through which it is conveyed out of the stomach into the Duodenum) is named Pylorus; where there is a circular valve which hinders a return of aliment out of the gut, but does not wholly hinder the gall from flowing into the stomach.

THE coats of the stomach are but three; the external membranous, the middle muscular, whose fibres are chiefly longitudinal and circular, the inner membranous, and beset with glands, which separate a Mucus. This last coat is again divided by anatomists into a fourth, which they call Villosa. As the muscular coat of the stomach contracts, the inner coat falls into folds, which increase as the stomach lessens, and consequently retard the aliment most when the stomach is nearest being empty.

THE manner in which digestion is performed has been matter of great controversy. The ancients generally supposed the food concocted by a fermentation in the stomach: But the moderns more generally attribute it to the muscular force of the stomach; which Dr. Pitcairne has computed to be equal to a hundred and seventeen thousand

land and eighty eight pound weight, to which being added the absolute force of the diaphragm and abdominal muscles; (but for what reason I am at a loss to conceive, when so small a part of that force can be exerted this way) the sum then will be more than twice as much; a force indeed equal to the end for which he assigns it. Now this force of the muscular coat of the stomach is near forty times greater than what Borelli has assigned to the heart, which is much stronger; and Dr. Keil has undertook to prove, that the force which the heart exerts is not thrice as many ounces as Borelli computes it to be thousand pounds weight. And this is as certain as that action and reaction are the same; that the abdominal muscles and the diaphragm, compress the stomach with no greater force than they do the liver and all other parts contained in the Abdomen; and that the Fœtus in Utero, and all the Viscera in the Abdomen, receive much more of this force, during the time of gestation; and yet neither the Fœtus, nor any other contained part, is digested by that force; and for the force with which the stomach it self acts, it will be just the same with the reaction of the food upon it, and therefore should be as much more liable to be digested by this and the other force than the food, as it oftner feels these forces than that, (only that living bodies are not so liable to digestion as dead ones): Besides, I think it may be demonstrated, that the force with which the stomach compresses any part of its contents, is not greater than what is given to equal parts of the contents in the small guts;

for



for if the moment of a muscle is as its weight, and and if the muscular coat of the stomach does not bear a greater proportion to the muscular coat of a small gut, than their diameters bear; a section of the stomach, having so many more equal parts to press than a like section of a gut; it will require just so much more force to give each part the same pressure. Dr. Drake has supposed, that digestion is performed in the stomach, as in Papin's digester, in which hypothesis are contained all the absurdities of that of Pitcairne's, with this addition, that the stomach must be as irresistible to distention at that time, as his iron pot, and the orifices as forcibly secured; but then indeed it shews how bits of bones, which dogs swallow may be retained in the stomach without tearing it; which difficulty, in my opinion, Dr. Pitcairne has not sufficiently accounted for, though it is none of the least in his hypothesis. In granivorous birds, where digestion is made by muscular force, their second stomach is plainly contrived for comminuting or digesting their food that way; for besides that it is one of the strongest muscles in their bodies, its inside is defended with a hard and strong membrane that it may not be torn; and these birds always eat with their grain the roughest and hardest little stones they can find, which are necessary for grinding their food, notwithstanding it is first soaked in another stomach, and is also food of very easie digestion. In snakes, some birds, and several kinds of fish, which swallow whole animals, and retain them long in their stomachs, digestion seems to be performed



formed by a Menstruum; for we frequently find in their stomachs animals so totally digested, before their form is destroyed, that their very bones are made soft. In horses and oxen, digestion is but little more than extracting a tincture; for in their excrements, when voided, we see the texture of their food is not totally destroyed, though grass in particular seems to be of as easy digestion as any food whatever, and the corn they eat is often voided entire; and in the excrements of men, are often seen the skins of fruits undigested, and small fruits, such as currants, unbroke, and worms also continue unhurt, both in the stomach and guts. Therefore by comparing our stomachs with those here mentioned, it appears to me that our digestion is performed by a Menstruum which is chiefly Saliva, assisted by the action of the stomach, and the abdominal muscles, and by that principle of corruption which is in all dead bodies. For digestion is no other than corruption of our food, and therefore quantities of hot spirits, which hinder the corruption of animal bodies, also hinder digestion.

DUODENUM, is the first of the three small guts; it begins from the Pylorus of the stomach, and is thence reflected downward; it first passes by the gall-bladder, and then under the following gut and mesentery, and coming in sight again in the left Hypochondrium, it there commences Jejunum, which is the second of the small guts; but the place where this ends and the other begins, is not precisely determined.

L

JEJUNUM,

Tab. xiv. 7. JEJUNUM, is so called from its being found for the most part empty; it is situated in the Regio Umbilicalis, and makes somewhat more than a third part of the small guts. It is distinguished from the following gut by its coats, which are a small matter thinner, and less pale.

Tab. xiv. 7. ILEUM, is the continuation of the former, situated in the Hypogastrium, and very often some part of it in the Pelvis of the Abdomen, upon the bladder of urine, especially in women; it enters the Colon on the right side, near the upper edge of the Os Ilium. This great length of the small guts is evidently for the convenience of a greater number of lacteals, that the chyle which misses their orifices in one place may not escape them in another. But those animals which swallow their food whole, and have it a long time in their stomachs and guts, have shorter guts and fewer lacteals.

COLON, is the first of the great guts; it begins at the upper edge of the right Os Ilium; thence ascending passes under some part of the liver, and the bottom of the stomach, from the right Hypochondrium to the left, and thence descends to the Pelvis Abdominis.

CÆCUM, or Appendicula Vermiformis, is situated on the beginning of the Colon; it is less than an earth-worm, with a small orifice opening into the Colon. This gut has seldom any thing in it. In men it is called one of the large guts, though it is the smallest by far; but the mistake arises from copying the ancients, whose descriptions of all the parts contained in the Abdomen seem

seem to be taken from dogs, for in them and in many other animals, it is very large: And some fish have them in great numbers, but very small; I have counted in a mackarell above 150.

RECTUM, is the continuation of the Colon through the Pelvis to the Anus.

THE guts have the same coats with the stomach; the fibres of their middle or muscular coat, are circular, or spiral, and longitudinal; of the latter but very few. The antagonists to these muscular fibres of the stomach and guts, are their contents pressed from one place to another, and the muscles of the Abdomen, for these pressing upon them alter their form into one less capacious; which necessarily extends their circular fibres. The great guts have three membranes, or ligaments, on the outside running their whole lengths, and supporting the Saculi, into which those guts are divided. The lesser guts, have at very small distances semilunar valves placed opposite to the interstices of each other; they prevent the aliment from passing too speedily through the guts; and the better to answer that end, they are larger and more numerous near the stomach, where the food is thinner, than they are towards the Colon, where the food is continually made thicker in its progress, by a discharge of part of the chyle. But brutes have them not, because they are not necessary to an horizontal posture. At the entrance of the Ileum into the Colon, are two very large valves, which effectually hinder the regrefs of the Fæces into the Ileum. But clysters have been frequently known to pass them,

and be vomited up; but the excrement that is sometimes vomited up, I am inclined to think, is such as had not passed into the great guts: The other valves in the Colon, are placed opposite (but not in the same plane) to each other, and make with their anterior edges an equilateral triangle; but as the gut approaches the Anus, they become less remarkable, and fewer in number.

ALL the guts have in their inner membrane an almost infinite number of very small glands: These glands will, some of them especially in the large guts appear to the naked eye when they are diseased: They are called *Glandulæ Pyerianæ*.

THE length of the guts to that of the body is as five to one in a middle-sized man; in taller men, the proportion is usually less, and in short men greater.

THE following case I had thus related (in presence of a great many gentlemen who had seen the case) from Mr. Punt of Cambridge, a gentleman, when living, well known for his great skill in Surgery.

“ I was called to a poor woman, a few years  
 “ since with a mortification upon the Abdomen.  
 “ I cut away the mortified part, and found some  
 “ of the small guts mortified. I cut off so much  
 “ of them as could not be saved, and stitched  
 “ the sound part of the gut, to a sound part of  
 “ the wound, near the navel; to which it after-  
 “ ward adhered, and she recovered and voided  
 “ her excrement that way, without any notable  
 “ inconvenience; and at every stool part of the  
 “ gut



“ gut would thrust out, without any pain, like a  
“ Prolapsus Ani: But about a year after the cure,  
“ she died of the stone.” I do not remember that  
he told me what caused this mortification, but  
my honoured friend Martin Folks, Esq; who lets  
nothing curious scape his observation, and was at  
that time of Clare-Hall in Cambridge, has informed  
me, “ That the mortification was made by  
“ laying hot bricks to her belly, for the cholick,  
“ some of which burnt her, and when the slough  
“ cast off a gut appearing, a female surgeon took  
“ it for a blister and clipped it, upon which the  
“ excrement came out of the wound, and then  
“ they sent for Mr. Punt. .

THE following case, was of a patient to Mr.  
Walter, a Surgeon, at Lewis in Suffex, whom I  
have heard relate it; but for this account, as well  
as the cut, I am obliged to my ingenious friend  
Dr. Russel, who saw the case; but I cannot be of  
Mr. Walter’s opinion, that it was the Colon that  
was mortified.

S I R,

“ **M**Rs. Stonestreet of Lewis in Suffex,  
“ had the Exomphalos above twenty  
“ years, before it was attended with the following  
“ accident. In the year 1700, the twenty eighth  
“ of May, she was taken with a cholick, and a  
“ total suppression of stools; the intestine morti-  
“ fied, and part of it was taken off by Mr. Wal-  
“ ter a Surgeon, who gave me an account of the  
“ case, and assured me it was the Colon; the  
“ other part was thrust out daily by the peristal-

L 3

tick



“ tick motion of the guts, when the excrements,  
 “ were voided, till it adhered to the wound;  
 “ and had the just appearance of what is expres-  
 “ ed in the picture I sent you. I had a perfect  
 “ examination of it in her life-time, but no op-  
 “ portunity of opening her after death; the  
 “ sides of the intestine firmly adhered to the bel-  
 “ ly, and the part which hung out, looked like  
 “ a pale scarlet strawberry, that had not its full  
 “ ripeness; and the coats of it were extremely  
 “ thickened. She lived in this condition twelve  
 “ years, and died of a fever, with scorbutick  
 “ swellings in her legs.

I am Sir, &c.

RICHARD RUSSEL.

Tab.xxiv. THE following case happened in my own pra-  
 ctice: Margaret White, the wife of John White,  
 a pensioner in the fishmongers alms-houses, at  
 Newington in Surry, in the fiftieth year of her  
 age had a rupture at her navel, which continued  
 till her seventy third year, when after a fit of  
 the cholick it mortified, and she being presently af-  
 ter taken with a vomiting, it burst. I went to  
 her and found her in this condition, with about  
 six and twenty inches and an half of the gut hang-  
 ing out mortified. I took away what was morti-  
 fied, and left the end of the sound gut hanging  
 out at the navel, to which it afterwards adhered,  
 and she recovered. It is now three years since  
 this accident happened, and she continues per-  
 fectly well, voiding the excrements through the  
 Intestine

Intestine at the navel, and though the ulcer was so large after the mortification separated, that the breadth of two guts was seen; yet they never at any time protruded out at the wound, though she was taken out of her bed and sat up every day.

BUT for a case nothing inferior to any of these, I am obliged to a farrier, or doctor for cattle, as he styles himself: The truth of this case is known to numbers of persons; as Mr. Hunt, a gentleman of unquestionable veracity has informed me, before whom the following account was given upon oath.

“ **T**HOMAS BRAYN of Yeaton, in the parish of Baschurch, and county of Salop, a doctor for cattle, maketh oath, that about ten or twelve years ago, he was sent for by a farmer or husbandman, who lived near the village called Maesbrooks, and very near to the river Verney, in the said county of Salop, to have his advice about an ox he had, which was there sick by reason he could not dung; he had been drenched by several beast-doctors, before this deponent came to him. This deponent seeing this ox in the condition he was in, told the owner, that if he would venture his ox, he would do him what service he could, in the curing of him; which the owner consented to, and thereupon this deponent opened the ox in the flank, and took out great part of his bowels, upon searching which he found there was a perfect stoppage in the guts; and

“ the gut was about the stoppage putrified for a-  
 “ bout three quarters of a yard, whereupon this  
 “ deponent cut off so much of the gut as was  
 “ putrified, and took it quite away, and then  
 “ drew the ends of the guts which remained  
 “ found after what was cut off, together upon a  
 “ hollow keck, which was about three or four  
 “ inches long, and sewed the said ends of the  
 “ guts together upon the said keck, leaving the  
 “ keck within the guts; and then sewed up the  
 “ hole cut in the hide upon the flank of the said  
 “ ox; and this deponent further saith, that with-  
 “ in the space of one hour after this operation was  
 “ performed, the ox dunged; and the piece of  
 “ the keck which the said ends of the gut were  
 “ sewn upon and left within the guts, came away  
 “ from the ox with the dung, whereupon the ox  
 “ recovered and lived to do the owner service se-  
 “ veral years.

Jurat' decimo septimo  
 die Julii, anno Dom.  
 1716. coram  
 Tho. Hunt.

The mark of  
 =  
 Thomas Brayn.

MESENTERY, is a membrane beginning  
 loosely upon the loins, and is thence produced to  
 all the guts: It preserves the Jejunum and Ileum  
 from twisting in their peristaltick or vermicular  
 motion, and confines the rest to their places. It  
 sustains all the vessels going to and from the guts,  
 viz. arteries, veins, lymphæducts, lacteals and  
 nerves, and also contains many glands, called  
 from

from their situation Mesentericæ. The beginning of this membrane from the loins, is about three or four inches broad, but next the guts of the same length with the side of the guts they adhere to, which is in the small guts about a fourth part shorter than the other side; but when this membrane is separated from the small guts, it shrinks, and measures about two thirds less.

I OPENED a boy about twelve years old, that died of the iliac passion; the guts, stomach, Duodenum and Jejunum were distended, with vapour and air, to near ten times their natural capacity, which so compressed the Intestinum Ileum, that nothing could pass through it. The relations of this boy could give no other account of the cause of this disease, than that of his having eaten a large quantity of raw young carrots. This case happens very frequently to lambs that have been housed, and turned out early in the spring to graze, when the grass is very rank and succulent; and also to horses, oxen and sheep, when they happen to feed by any accident, upon young beans or peas, or rich clover grass, which are full of air, and very apt to ferment and expand in their stomachs: In these animals this case is commonly cured by running a knife into their guts, some instances of which I have seen, and have heard a great many reported; but this case happening very rarely to men, and being to be cured sometimes by the swallowing of crude mercury, I believe that practice has never yet been used; though the instrument which is used for tapping in a dropsy of the Abdomen, would do  
it



it with great ease and safety. Some anatomists, who have considered the impossibility of a twisting of the guts, (which is the vulgar name of this disease) have imagined that it proceeded from one gut being involved in another; but these involutions, are found in most bodies that die a natural death, and without any inflammation, or any other symptom of pain.

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## C H A P. V.

### *Of the liver, gall-bladder, pancreas and spleen.*

Tab. xiy.  
xv. 4.

**T**HE LIVER, is the largest gland in the body, of a dusky red colour. It is situated immediately under the diaphragm in the right Hypochondrium; its exterior side is convex, and interior concave; backward toward the ribs it is thick, and thin on its forepart, where it covers the upper side of the stomach, and some of the guts; the upper side of it adheres to the diaphragm, and is also tyed to it and the Sternum by a thin ligament, which is described commonly as two; the upper part called Suspensorium, and the anterior Latum; but either of these names is sufficient for it all: It is also tied to the navel by a round ligament called Teres or Umbilicale, which is the umbilical vein degenerated into a ligament; it is inserted into the liver at a small fissure.



fissure in its lower edge. The Ligamentum Latum or Suspensorium, sustains the liver in an erect posture, or rather fixes it in its situation, while it is supported by the other Viscera, they being compressed by the abdominal muscles; in lying down, the Teres prevents it from pressing on the diaphragm; and in lying on the back, they both together suspend it, that it may not compress and obstruct the ascending Vena Cava. I suppose it is nourished by the branches of the celiac and mesenteric arteries in the liver called Arteriæ Hepaticæ; but its blood-vessels, that compose it as a gland, are the branches of the Vena Portæ, which enters the liver, and distributes its blood like an artery, to have the bile secreted from it, (Vid. Vena Portæ) and the branches of the Cava in the liver, which return the redundant blood into the Cava Ascendens. It has also several branches of nerves, and a great number of lymphaticks: Of which I shall treat in their respective places. Dogs and cats and other animals, that have a great deal of motion in their backs, have their livers divided into many distinct lobules; which by moving one upon another, comply with those motions, which else would break their livers to pieces.

THE gall-bladder, is a receptacle of bile, seated in the hollow-side of the liver; it is composed of one dense coat somewhat muscular, which is covered with a membrane like that of the liver; and is also lined with another, that cannot easily be separated,

MODERN anatomists have described a number of small ducts leading from the liver to the gall-bladder, by which they suppose the gall-bladder is filled, and these I thought I had seen in a human body that died of a jaundice, when I was a very young anatomist; but never being able to see any since in any animal, though I have made very diligent enquiry by experiments and dissection, I begin now to be persuaded that there are no such ducts; for if they are too little to be seen or filled by injections, I think they are much too little for the end for which they are assigned. As to the argument for the existence of such ducts, which is fetched from the difficulty of the gall-bladder's being filled through the Ductus Cysticus from the Ductus Hepaticus, I think it is of no weight, because the Vesiculæ Seminales, we know, are filled with a thicker fluid through a less direct passage. From the gall-bladder towards

Tab.xx.4. the Duodenum, runs a duct called Cysticus; and

Tab.xx.1. from the liver to this duct, one called Hepaticus, which carries off the gall this way, when the gall-

Tab.xx.5. bladder is full; then the ductus Cysticus and Hepaticus being united, commence Ductus Communis Choledochus, which enters the Duodenum obliquely about four inches below its beginning. The orifice of this duct in the gut is somewhat eminent, but has no caruncle, as is commonly said. As the liver from its situation in the same cavity with the stomach, will be most pressed and consequently separate most gall when the stomach is fullest, which is the time when it is most wanted; so the gall-bladder, being seated against the  
Duo-

Duodenum, will have its fluid pressed out by the aliment passing through that gut, and consequently at a right time, and in due proportion; because the greater that quantity of aliment is, the greater will be the compression; and so the contrary.

PANCREAS, the sweet-bread, is a large gland Tab.xv.6; of the salivary kind, lying a-cross the upper and back-part of the Abdomen, near the Duodenum. It is what the antients called a conglomerate gland, appearing so without dissection to the naked eye; it has a short excretory duct, about half as large as a crow-quill, though it is commonly painted as large as the Ductus Communis Chole-dochus: It always enters the Duodenum together with the bile duct; but in dogs some distance from it; and, I think, always in two ducts distant from one another. The juice of this gland, together with the bile, serves to complete the digestion of the aliment, and render it fit to enter the lacteal vessels.

THE spleen, is seated in the left Hypochondrium, immediately under the diaphragm, and D. above the kidney, between the stomach and the ribs; it is supported by the sub-contained parts, and fixed to its place by an adhesion to the Peritoneum and diaphragm; it is also connected to the Omentum, as has been observed. The figure of it is a sort of depressed oval, near twice as long as broad, and almost twice as broad as thick: Sometimes it is divided into lobules, but for the most part, has only one or two small fissures on its edge, and sometimes none. In its colour it resembles

resembles cast-iron. The inner texture in brutes is vesicular, like the Penis; in which vesicles are found grumous blood, and small bodies, like glands: But Ruysch denies that the human spleen is of the same texture.

I KNOW no way of computing with any exactness, the quantity of bile that is usually secreted by the liver in a given time; but if it is four times as much as all the salivary glands secrete, it may be twenty four ounces for every meal; to which being added six ounces of Saliva, which, from what I have observed in the chapter of the salivary glands, I think will appear a moderate computation. And supposing the Pancreas in the same time secretes three ounces, there will then be thirty three ounces of fluids separated for the digestion of one meal; and that these necessary fluids may not be wasted in such quantities, they pass into the blood with the chyle, and may be soon separated again for the same use; and very likely, some of the same bile may be employed more than once, for digesting part of the same meal: And as the liver exceeds all the glands in the body in magnitude, and its excretory ducts ending in the Duodenum, it seems to me to be much more capable of making those large separations from the blood, which are procured by catharticks, than the scarce visible glands of the guts.

THE liver, ordinarily weighs, in a middle-sized man, about three pounds twelve ounces, the Pancreas three ounces, and the spleen fourteen ounces. The spleen I have taken out of a



dog, without any remarkable inconvenience to him. And I have twice, in a humane body, seen three spleens, twice two, and once four; some of these were very small, others nearly equal, but all together in any of these bodies, were not greater than the one which is usually found. I have seen a diseased liver in a man, that weighed fourteen pounds four ounces; and in a boy but nine years old, that died hydropick, I found the liver full of hydatids, and cysts of hydatids adhering to it, which together weighed seven pounds, one ounce and a half, though several pints of water had been let out of it before. The spleen, in the same boy, together with the hydatids contained in its membrane, weighed three pounds: In a man I found a diseased spleen, weighing five pounds two ounces; and in an old man six foot high, I found a sound liver, weighing no more than twenty eight ounces, and the spleen but ten ounces: And in a man that was cured of a dropsy, I found a Polypus very solid, almost filling the large branches of the Porta in the liver, and a stone between the liver and gall bladder, larger than a nutmeg; and in a man that died of a jaundice, I found the Ductus Communis Choledocus, constricted by a scirrhus Pancreas, the gall-bladder extended to the size of a goose-egg, and all the ducts to twice their natural bigness. This is the case in which I thought I had so plainly seen the cystyhepatick ducts; I once saw the Ductus Cysticus obstructed without the gall-bladder, being distended so much as is usual, which, I think, furnishes us with a very probable argument



gument against the existence of cystyhepatick ducts.

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## C H A P. VI.

### *Of the Vasa Lactea.*

**V**ASA LACTEA, are the Venæ Lactææ, Receptaculum Chyli, and Ductus Thoracicus.

VENÆ LACTÆÆ, &c. are a vast number of very fine pellucid tubes, beginning from the small guts, and proceeding thence through the mesentery; they frequently unite, and form fewer and larger vessels, which first pass through the mesenterick glands, and then into the Receptaculum Chyli: These vessels e'er they arrive at the mesenterick glands, (or in dogs the Pancreas Affellii, which is these glands collected) are called Venæ Lactææ Primi Generis; and thence to their entrance into the Receptaculum Chyli, Venæ Lactææ Secundi Generis. The office of these veins, is to receive the fluid part of the digested aliment, which is called chyle, and convey it to the Receptaculum Chyli, that it may be thence carried through the Ductus Thoracicus into the blood-vessels.

FOR the following excellent description (thus marked“) of the Receptaculum Chyli, and Ductus Thoracicus, I am obliged to Mr. Monro.

“ RECEPTACULUM CHYLI, Pecqueti, or  
 “ Saccus Lacteus, Van Horne, is a membranous  
 somewhat

“ what pyriform bag, two thirds of an inch long,  
“ one third of an inch over in its largest part,  
“ when collaps’d ; situated on the first Vertebra  
“ Lumborum, to the right of the Aorta, a little  
“ higher than the Arteria Emulgens Dextra, un-  
“ der the right inferior muscle of the diaphragm ;  
“ it is formed by the union of three tubes, one  
“ from under the Aorta, the second from the in-  
“ terstice of the Aorta and Cava, the third from  
“ under the emulgents of the right side. The  
“ Saccus Chyliferus at its superior part becoming  
“ gradually smaller is contracted into a slender  
“ membranous pipe of about a line diameter, well  
“ known by the name of

“ DUCTUS THORACICUS, this passes be-  
“ twixt the Appendices Musculosæ Diaphragma-  
“ tis, on the right of, and somewhat behind the  
“ Aorta, then lodged in the cellular substance  
“ under the Pleura, it mounts between this arte-  
“ ry and Vena Sine Pari, or Azygos, as far as  
“ the fifth Vertebra Thoracis, where it is hid by  
“ the Azygos, as this vein rises forward to join  
“ the Cava Descendens, after which the duct  
“ passes obliquely over to the left side under the  
“ Œsophagus, Aorta Descendens, and great cur-  
“ vature of the Aorta, until it reaches the left  
“ carotide, stretching farther towards the left in-  
“ ternal jugular, by a circular turn, whose con-  
“ vex is upmost ; at the top of this arch it splits  
“ into two for one half line, the superior branch  
“ receiving into it a large lymphatick from the  
“ cervical glands. This lymphatick appears by  
“ blowing and injections to have no valves ; when  
M “ the

“ the two branches are united, the duct continues  
 “ its course to the internal jugular, behind which  
 “ it descends, and immediately at the left side of  
 “ the insertion of this vein, enters the superior  
 “ and and posterior part of the left subclavian,  
 “ whose internal membrane duplicated forms a se-  
 “ milunar externally convex valve that covers two  
 “ thirds of the orifice of the duct; immediately  
 “ below this orifice a cervical vein from the Mus-  
 “ culi Scaleni enters the subclavian. The thin  
 “ coat and valves, commonly ten or twelve, of  
 “ this duct are so generally known, I need not  
 “ mention them. In my notes I find little vari-  
 “ ation in the Receptaculum, only its different  
 “ capacities in different subjects, and sometimes  
 “ more ducts concurring in the formation of  
 “ it.

“ THE diameter of the duct varies in most  
 “ bodies, and in the same subject is uniform, but  
 “ frequently sudden enlargements or Saeculi of it  
 “ are observable. The divisions which authors  
 “ mention of this duct within the Thorax are very  
 “ uncertain: In a woman I dissected last summer,  
 “ at the eighth Vertebra Thoracis, one branch  
 “ climbed over the Aorta, and about the fifth  
 “ Vertebra slipped back again under that artery  
 “ to the other branch, which continued in the  
 “ ordinary course. Last winter I found this duct  
 “ of a man discharging it self entirely into the  
 “ right subclavian vein.

“ THE precise Vertebra where it begins to  
 “ turn towards the left is also uncertain. Fre-  
 “ quently it does not split at its superior arch,

“ in

“ in which case a large Saccus is found near its  
“ aperture into the subclavian vein.

“ GENERALLY it has but one orifice,  
“ though I have seen two in one body, and three  
“ in another; nay, sometimes it divides into two  
“ under the curvature of the great artery, one  
“ goes to the right, another to the left subclavi-  
“ an; this however is very rare. The lymphatic,  
“ which enters the superior arch, is often  
“ sent from the thyroide gland.”

SUPPOSING there ordinarily passes five pounds of chyle in a day through the lacteals, and that four ounces of this only is added to the blood, (though it may be any other quantity for ought I know) and that a man neither decreases nor increases during this time, then all the separations from the fluids and solids must be just five pounds; four ounces of which must be those fluids and particles of solids, which are become unprofitable; and the remaining four pounds twelve ounces, will serve as a vehicle to carry the four ounces off: So that we see for what reason more fluids are carried into the blood than are to be retained there, and how the body is by the same means both nourished and preserved in health.

THE chyle is diluted in its passage by the lymph. Vid. chap. of the Lymphaticks.

## C H A P. VII.

*Of the Pleura, Mediastinum, Lungs,  
Pericardium, and Heart.*

**P**LEURA is a fine membrane which lines the whole cavity of the Thorax, except on the diaphragm, which is covered with no other than its own proper membrane; the back part of it is extended over the great vessels, like the Peritoneum; and in regard this membrane passes partly under these vessels, as the Peritoneum does in the Abdomen, they may be said to lie in a duplicature of it; it serves to make the inside of the Thorax smooth and equal.

**MEDIASTINUM**, (if we may describe such a membrane in the humane body) divides the Thorax lengthways, from the Sternum to the Pericardium and Pleura, which is a very short space, but in many brutes very considerable. It divides into two in men, but in brutes it is single; it divides the Thorax not exactly in the middle, but towards the left side, and is so disposed, that the two cavities, into which it divides the Thorax, do not end toward this membrane in an angle, but a segment of a circle; it hinders one lobe of the lungs from incommoding the other, as in lying on one side the uppermost would frequently do;



do; and prevents the disorders of one lobe of the lungs from affecting the other.

THE lungs, are composed of two lobes, one Tab. xiv seated on each side of the Mediastinum, each of <sup>2</sup> which lobes are sub-divided into two or three lobules, which are most distinctly divided in such animals as have most motion in their backs, for the same end that the liver is in the same animals; they are each composed of very small cells, which are the extremities of the Aspera Arteria or Bronchos. The figure of these cells is irregular; yet they are fitted to each other, so as to have common sides, and leave no void space. Dr. Willis has given a very particular description of the inner texture of the lungs, but it is wholly imaginary and false, as he, and they who have copied his cuts and descriptions could not but have known, if they had ever made the least enquiry into the lungs of any animal; nor is his account of the lymphaticks on the surface of the lungs, at all more true than that of their texture. In the membranes of these cells are distributed the branches of the pulmonary artery and vein. The known uses of the air's entering the lungs, are to be instrumental in speech, and to convey Effluvia into the nose, as it passes, for the sense of smelling; but the great use of it by which life is preserved, I think, we do not understand. By some the force of the air is thought to separate the Globuli of the blood, that have cohered in the slow circulation through the veins; and this opinion seems to be favoured by the many instances of Polypusses (which are large concretions of

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the Globuli of the blood) found in the veins near the heart, and in the right auricle and ventricle of the heart, and their being so seldom found in the pulmonary veins, or in the left auricle or ventricle of the heart, or in any of the arteries; but if it is true that, while the blood passes through the lungs, many cohering Globuli are separated, yet it remains to be proved that these separations are made by the force of the air. Dr. Keil has computed the force of the air in the strongest expirations against the sides of all the vesicles, to be equal to fifty thousand pound weight, yet if we consider we shall still find the moment of the air in the lungs exceeding small in any small space. For the velocity with which the air moves in the lungs, is as much less than that with which it moves in the wind-pipe, as the square of a section of the cells in the lungs is greater than the square of a section of the wind-pipe; and therefore if the square of all the extreme blood-vessels in the lungs, do not bear a greater proportion to the square of the large pulmonary vessels than the square of the cells do to the wind-pipe, and if the blood in these large vessels moves as fast as the air in the wind-pipe; (all which I think may be granted) then the blood moving in the smallest vessels of the lungs with a velocity equal to that of the air in the cells, the blood will have as much more pressure from the power that moves it in its own vessels than the air can give upon them, as blood is heavier than air. Besides, air pressing equally to all sides, and the Globuli of the blood swimming in a fluid; this pressure, be  
it

it what it will, I think, can be of little use to make such separations. Indeed it may be objected that the greatest pressure is in expiration, yet that surely cannot be much greater, while the air has so free a passage out of them. Others have thought that the air enters the blood-vessels from the cells in the lungs, and mixes with the blood; but this opinion, however probable, wants sufficient experiments to prove it; air being found in the blood, as there certainly is, is no proof of its entering this way, because it may enter with the chyle: Nor is the impossibility which has been urged of its entering at the lungs without the blood being liable to come out the same way into the vesicles of the lungs, a good argument to the contrary; for if a pliable duct passes between the membranes of a vessel, through a space greater than the square of its orifice, no fluid can return, because the pressure which should force it back will be greater against the sides of that duct than its orifice; which is the case of the bile duct entering the Duodenum, and the ureters entering the bladder. I think the best arguments for the air's entering into the blood by the lungs, or rather some particular part of the air, may be fetched from what the learned Dr. Halley, and others have observed of a man's wanting in a diving bell, near a gallon of fresh air in a minute, for if nothing but pressure had been wanted from the air in the lungs, there may be thrice as much pressure without any supply of fresh air, as upon the surface of the earth; and animals dying so soon in an air that has been burnt, and their being so

easily intoxicated by breathing air much impregnated with spirituous liquors, are also, in my opinion, arguments of a passage this way into the blood. Besides, if pressure of the air in the cells of the lungs is the only use of it, I do not see but enough of that may be had while a man is hanging, if the muscles of the Thorax do but act upon the air which was left in the Thorax, when the rope was first fixed, and yet death is brought about by hanging no other way than by interrupting of the breath, as I have found by certain experiments. Dr. Drake has endeavoured to shew, that the use of respiration is to assist the Systole of the heart; but this use requires that the Systole and Diastole of the heart, should keep time with expiration and inspiration, which is contrary to experience: Besides, if his hypothesis was true, it could only serve the right ventricle of the heart. The lungs of animals before they have been dilated with air, are specifically heavier than water, but upon inflation they become specifically lighter and swim in water; which experiment may be made to discover whether a dead child, was still born or not; but if the child has breathed but a little, and the experiment is made long after, the lungs may be collapsed, and grow heavier than water, as I have experimented, which may lead a man to give a wrong judgment in a court of judicature; but then it will be on the charitable side of the question.

ADHESIONS of the lungs to the Pleura are so common, I know not how to call it a disease; they being found so more or less in most adult persons,

persons, and without any inconveniennce, if the lungs are not rotten.

PERICARDIUM or heart-purse, is an ex-  
ceeding strong membrane which covers the heart; Tab. xiv  
f.  
its side next the great vessels is partly connected to them, and partly to the basis of the heart; but, I think, not properly perforated by those vessels, and its lower side is inseparable from the tendinous part of the diaphragm, but not so in brutes, in some of which there is a membranous bag between it and the diaphragm, which contains a lobe of the lungs. It encloses all the heart to its basis; its uses are to keep the heart in its place, without interrupting its office, to keep it from having any friction with the lungs, and to contain a liquor to lubricate the surface of the heart, and abate its friction against the Pericardium.

THE heart is a muscle of a conick figure, with two cavities or ventricles; its basis is fixed by the vessels going to and from it, upon the fourth and fifth Vertebrae of the Thorax, its Apex, or point is inclined downward and to the left side, where it is received in a cavity of the left lobe of the lungs, as may be observed, the lungs being extended with air: This incumbrance on the left lobe of the lungs, I imagine, is the cause of that side's being most subject to those pains which are usually called pleuritic, which, I think, are for the most part inflammations in the lungs.

AT the basis of the heart, on each side, are situated the two auricles to receive the blood; the right from the two cava's, and the left from the pulmonary-veins: In the right, at the meeting of  
the



the cava's, is an eminence called *Tuberculum Loweri*, which directs the blood into the auricle; immediately below this tubercle, in the ending of the *Cava Ascendens*, is the *Vestigium* of the *Foramen Ovale*; (Vid. chap. of the *Fœtus*) and near this, in the auricle, is the mouth of the coronary veins. The left auricle is abundantly less than the right; but the difference is supplied by a large muscular cavity, which the veins from the lungs afford in that place; the sides of this muscular cavity are thicker than the sides of the right auricle, in about that proportion in which the left ventricle of the heart is stronger than the right; their uses being to receive blood from the veins that lead to the heart, and press it into the ventricles; a strength in each auricle proportionable to the strength of the ventricle that it is to fill with blood, seems necessary: And this different thickness of the coats of the auricles makes the blood in the left, which is thickest, appear through it of a paler red; but when it is let out of the auricles it appears alike from both; which they would do well to examine, who affirm the blood returns from the lungs of a more florid colour than it went in; and offer it as an argument, of the blood's being mixed with air in the lungs: In both auricles are muscular *Columnæ*, like those in the ventricles, but smaller.

THE ventricles or cavities in the heart which receive the blood, are hollow muscles, or two cavities in one muscle, whose fibres intersect one another, so as to make the pressure of the heart upon the blood more effectual, and are also less li-

able

able to be separated than they would have been if they had lain parallel ; both these cavities receiving the same quantities of blood in the same times, and always acting together, must be equal in size, if they equally discharge what they contain at every Systole, as I doubt not but they do ; nevertheless the left appears less than the right, it being found empty in dead bodies, and the right usually full of blood, which made the ancients think the veins and the right ventricle only, were for the blood to move in, and that the left and the arteries contained only animal spirits ; the left ventricle is much the thickest and strongest, its office being to drive the blood through the whole body, while the right propels it through the lungs only. Over the entrance of the auricles in each ventricle, are placed valves to hinder a return of blood while the heart contracts. Those in the right ventricle are named Tricuspides, those in the left Mitrales. One of these last seem to do farther service, by covering the mouth of the Aorta while the ventricle fills ; which suffering none of the blood to pass out of this ventricle into the Aorta before the ventricle acts, it will be able to give greater force to the blood than it otherwise might have done ; because a greater quantity of blood more fully distending the ventricle, and making the greater resistance, it will be capable of receiving the greater impressed force from the ventricle, and if the blood is no way hindered in the right ventricle from getting into the pulmonary artery, while the ventricle dilates as it is in the left, the left  
then

then must be somewhat bigger than the right, if they both empty themselves alike in every Systole: Though the auricles of the heart are equal to each other, and the two ventricles also equal, or nearly equal, yet the auricles are not so large as the ventricles; for the ventricles contain not only all the blood which flowed from the veins into the auricles, during the contraction of the heart, but also that which flows (which will be directly into the heart) while the auricles contract, and the ventricles dilate; which leads us to the exact knowledge of the use of the auricles. If the Systole and Diastrale of the heart are performed in equal times, then the auricles must be half the size of the ventricles; or whatever proportion the space of time of the Systole of the heart, bears to the space of time in which the Systole and Diastrale are both performed, that proportion will the cavities of the auricles bear to the cavities of the ventricles.

THE inner fibres of each ventricle are disposed into small cords, which are called Columnæ: From some of these stand small portions of flesh called Papillæ; these Papillæ are tied to the valves by slender fibres, whereby they keep the valves from being pressed into the auricles, by the action of the blood against them in the Systole of the heart, and when that is over, the blood flowing in between them opens them, as the pressure of blood on the other side shuts them in the Systole. (For the course of the blood through this part, Vid. chap. of the course of the aliment and fluids.)

IN the beginning of each artery from the heart are placed three valves, which look forward, and close together to hinder a regrefs of blood into the ventricles. Those in the pulmonary artery, are named Sigmoidales, those in the Aorta, Semilunares, Canalis Arteriosus. (Vid. chap. of the Fœtus.)

IN a boy I found a great quantity of Pus in the Pericardium, and the basis of the heart ulcerated. In persons that have died of a dropfy, I have usually observed the heart large, its fibres lax, and the vessels about it immoderately distended, and polypusses sometimes in both auricles and ventricles, and in the large veins; but more frequently in the right auricle and ventricle. I dissected a man that died tabid, in whom the Pericardium universally adhered to the heart, and a portion of the muscular part of the heart was ossified as large as a six-pence. The beginning of the Aorta, has been frequently seen ossified, especially in aged persons. In a woman that died of a dropfie, I found the valves of the Aorta quite covered with chalk stones, which not suffering the valves to do their office, the left ventricle of the heart was constantly overcharged with blood, and distended to above twice its natural bigness, which I imagine destroyed the œconomy of the body, and occasioned the dropfie.

Tab.ix.A.

## C H A P. VIII.

*Of the arteries and veins.*

**F**ROM the right ventricle of the heart arises the pulmonary artery, which soon divides into two branches, one to each lobe of the lungs, and then they sub-divide into smaller and smaller branches, until they are distributed thro' every part of the lungs. From the extreme branches of the pulmonary artery, arise the small branches of the pulmonary veins; which as they approach the left auricle of the heart, unite in such a manner as the pulmonary artery divides going from the heart, only that the veins enter the muscular appendix of the left auricle in several branches, and the blood being brought back from the lungs by these vessels to the left auricle and ventricle of the heart, it is from the left ventricle of the heart thrown into the Aorta.

**AORTA**, or great artery, arises from the left ventricle of the heart, and deals out branches to every part of the body. The first part of this vessel, is called Aorta Ascendens; it passes over the left pulmonary artery, and veins and branch of the Aspera Arteria, and being reflected under the left lobe of the lungs, it commences Aorta Descendens; which name it keeps through the Thorax and Abdomen where it passes on the left side of the spine, till its division into the iliac arteries



ries between the third and fourth Vertebræ of the loins.

FROM under two of the semilunar valves of the Aorta, which is e'er it leaves the heart, arise two branches (sometimes but one) which are bestowed upon the heart, and are called *Coronariæ Cordis*. From the curved part of the Aorta, which is about two or three inches above the heart, arise the subclavian and carotid arteries; the right subclavian and carotid in one trunk, but the left single. By some authors these vessels have been described in a different manner, but I believe their descriptions were, for want of human bodies, taken from brutes; for I have never yet seen any variety in these vessels in humane bodies, though I have in the veins nearer the heart: And indeed there seems to me to be a mechanical necessity for their going off in the manner here described in human bodies; for the right subclavian and carotid arteries necessarily going off from the Aorta at a much larger angle than the left, the blood would move more freely into the left than the right, if the right did not go off in one trunk, which gives less friction to the blood, than two branches equal in capacity to that one; so that the advantage the left have by going off from the Aorta, at much acuter angles than the right, is made up to the right by their going off at first in but one branch.

THE carotid arteries run on both sides the Larynx to the sixth Foramina of the scull, through which they enter to the brain; but as they pass through the neck, they detach branches to every

part about them, which branches are called by the names of the parts they are bestowed upon; as, Laryngeæ, Thyroideæ, Pharyngeæ, Linguales, Temporales, Occipitales, Faciales, &c. but just before they enter the sixth Foramina of the scull, they each send a small branch through the fifth Foramina of the scull to that part of the Dura Mater which contains the Cerebrum. It is these arteries which make those impressions which are so constantly observed on the inside of the *Offa Bregmatis*: These branches Mr. Monro observes oftener arise from the temporal arteries. The internal carotids send two branches to the back part of the nose, and several branches thro' the first and second Foramina of the scull to the face and parts contained within the orbits of the eyes, and then piercing the Dura Mater, they each divide into two branches, one of which they send under the Falx of the Dura Mater, between the two hemispheres of the brain, and the other between the anterior and posterior lobes. These branches take a great many turns, and divide into very small branches in the Pia Mater before they enter the brain, as if large trunks would make by their pulse too violent an impression on so tender and delicate a part. And perhaps it may be from an increase of the impulse of the arteries in the brain, which strong liquors produce, that the nerves are so much interrupted in their uses throughout the whole body, when a man is intoxicated with drinking; and it may also be from a like cause, that men are delirious in fevers. Besides these two arteries, viz. the carotids, the  
 brain

brain has two more, called *Cervicales*, which arise from the *subclavian* arteries, and ascend to the head through the *Foramina*, in the transverse processes of the cervical *Vertebræ*, and into the skull through the tenth or great *Foramen*; these two arteries uniting soon after their entrance, they give off branches to the *Cerebellum*, and then passing forward, divide and communicate with the *carotids*; and the *carotid* arteries communicating with each other, there is an entire communication between them all; and these communicant branches are so large that every one of these great vessels, with all their branches may be filled with wax injected through any one of them, as I have often experienced.

THE *subclavian* arteries, are each continued to the cubit in one trunk, which is called *Axillaris* as it passes the arm-pits, and *Humeralis* as it passes by the inside of the *Os Humeri*, between the muscles that bend and extend the cubit. From the *subclavians* within the breast arise the *Arteriæ Mammariæ*, which run on the inside of the *Sternum*, and lower than the *Cartilago Ensiformis*. As soon as the *Arteria Humeralis* has passed the joint of the cubit, it divides into two branches, called *Cubitalis Superior* and *Cubitalis Inferior*; which latter soon sends off a branch, called *Cubitalis Media*, which is bestowed upon the muscles seated about the cubit. The *Cubitalis Superior* passes near the *Radius*, and round the root of the thumb, and gives one branch to the back of the hand, and two to the thumb, one to the first finger, and a branch to communicate with the

N                      *Cubitalis*

Cubitalis Inferior. The Cubitalis Inferior passes near the Ulna to the palm of the hand, where it takes a turn, and sends one branch to the out-side of the little finger, another between that and the next finger, dividing to both, another in the same manner to the two middle fingers, and another to the two fore-fingers. These branches which are bestowed on the fingers, run one on each side of each finger internally to the top, where they have small communications, and very often there is a branch of communication between the humeral and inferior cubital arteries. This communicant branch is sometimes very large, and liable to be pricked by careless or injudicious blood-letters, in bleeding in the basilic vein, immediately under which, as far as I have been able to observe, this branch always lies. Mr. Monro has found the subclavian artery divided in one subject into two, the exterior of which formed the Cubitalis Superior, and the inner artery, the Cubitalis Inferior; from which structure he accounts for the success in the operation of the aneurism sometimes performed above the cubit. When the operation for an aneurism is made upon this communicant branch, it is necessary to tie it on both sides of the orifice, because the blood is liable to flow freely into it either way.

FROM the descending Aorta on each side is sent a branch under every rib, called Intercoastalis, and about the fourth Vertebra of the back, it sends off two branches to the lungs, called Bronchiales, which are sometimes both given off from the Aorta, sometimes one of them from the intercoastal



tercoſtal of the fourth rib on the right ſide; and as the Aorta paſſes under the diaphragm, it ſends two branches into the diaphragm, called *Arteriæ Phrenicæ*, which ſometimes riſe in one trunk from the Aorta, and ſometimes from the *Cœliaca*; but oftener the right from the Aorta, and the left from the *Cœliac*. Immediately below the diaphragm ariſes the *cœliac artery* from the Aorta; it ſoon divides into ſeveral branches, which are beſtowed upon the liver, Pancreas, ſpleen, ſtomach, Omentum, and Duodenum. Theſe branches are named from the parts they are beſtowed on, except two that are beſtowed upon the ſtomach, which are called *Coronaria Superior* and *Inferior*, and the branch beſtowed upon the Duodenum, which is named *Inteſtinalis*. At a very ſmall diſtance below the *Arteria Cœliaca* from the Aorta, ariſes the *Mefenterica Superior*, whoſe branches are beſtowed upon all the *Inteſtinum Jejunum* and *Ileum*, part of the Colon, and ſometimes one branch upon the liver. A little lower than the ſuperior meſenteric artery, ariſe the *emulgents*, which are the arteries of the kidneys. And a little lower than the *emulgents*, forward from the Aorta, ariſe the *Arteriæ Spermaticæ*. For which, Vid. chap. of the parts of the generation in men. Lower laterally, the Aorta ſends branches to the loins called *Lumbales*, and one forward, to the lower part of the Colon and the *Rectum*, called *Mefenterica Inferior*. Between the *Arteria Cœliaca* *Mefenterica Superior* and *Inferior*, and the branches of each near the guts, there are large communicant branches to convey



the blood from one to another when they are either compressed in any posture, or streightened by being stretched out in ruptures, or from any other cause.

As soon as the Aorta divides upon the loins, it sends off an artery into the Pelvis upon the Os Sacrum, called *Arteria Sacra*, and the branches the Aorta divides into, are called *Iliacæ*, which in about two inches space divide into external and internal. The *Iliacæ Internæ* first send off the umbilical arteries which are dried up in adult bodies, except at their beginnings, which are kept open for the collateral branches on each side, one to the bladder, and one to the Penis in men, and in women the Uterus; the rest of these branches are bestowed upon the buttocks, and upper parts of the thighs. The *Iliacæ Externæ*, run over the *Ossa Pubis* into the thighs; and as they pass out of the Abdomen, they send off branches, called *Epigastricæ*, to the forepart of the integuments of the Abdomen under the *Recti* muscles. And the epigastrick arteries send each a branch into the Pelvis and through the *Foramina* of the *Ossa Innominata* to the muscles thereabouts. As soon as the iliac artery is passed out of the Abdomen into the groin, it is called *Inguinalis*, and in the thigh *Cruralis*, where it sends a large branch to the back part of the thigh; but the great trunk is continued internally between the flexors and extensors of the thigh, and passing through the insertion of the *Triceps* muscle into the ham, it is there called *Poplitea*; then below the joint it divides into two branches, one of which is called

*Tibialis*

Tibialis Antica; it passes between the Tibia and Fibula to the fore-part of the leg, and is bestowed upon the great toe, and one branch to the next toe to the great one, and another between these toes to communicate with the Tibialis Postica; which artery, soon after it is divided from the Antica, sends off the Tibialis Media, which is bestowed upon the muscles of the leg, while the Tibialis Postica goes to the bottom of the foot and all the lesser toes. The Tibialis Antica is disposed like the Cubitalis Superior; the Postica, like the Cubitalis Inferior; and the Media in each, have also like uses. These arteries which I have described, are uniform in most bodies, but the lesser branches are distributed like the branches of trees, and in so different a manner in one body from another, that these vessels, it is highly probable, are in no two bodies alike, nor the two sides in any one body.

I HAVE once seen a rupture of matter, and once of blood and matter, which flowed out of the Abdomen into the fore-part of the thigh, through the same passage at which the iliac artery goes out of the Abdomen.

THE veins arise from the extremities of the arteries, and make up trunks which accompany the arteries in almost every part of the body, and have the same names in the several places which the arteries have, which they accompany. The veins of the brain unload themselves into the Sinuses, (Vid. chap. of the Dura and Pia Mater) and the Sinuses into the internal jugulars and cervicals, and the internal jugulars and cervicals into

the subclavians, which joining, make the Cava Descendens. The internal jugulars are seated by the carotid arteries and receive the blood from all the parts which the carotids serve, except the hairy scalp and part of the neck, whose veins enter into the external jugulars, which run immediately under the *Musculus Quadratus Genæ*, often two on each side. The cervical veins, descend two through the Foramina in the transverse processes of the cervical *Vertebræ*, and two thro' the great Foramen of the spine, and one on each side the spinal marrow; these join at the lowest Vertebra of the neck, and then empty into the subclavians, and at the interstices of all the *Vertebræ* communicate with one another.

THE veins of the arm are more than double the number of the arteries, there being one on each side each artery, even to the smallest branches that we can trace, besides the veins which lie immediately under the skin. Those which accompany the arteries have the same names with the arteries; those which run immediately under the skin on the back of the hand have no proper names, they run from thence to the inside of the elbow; where the uppermost is called *Cephalica*, the next *Mediana*, the next *Basilica*. These all communicate near the joint of the elbow, and then send one branch which is more directly from the *Cephalica*, and bears that name, until it enters the subclavian vein; it passes immediately under the skin, in most bodies, between the flexors and extensors of the cubit, on the upper side of the arm. The other branches joining, and  
receiving

receiving those which accompany the arteries of the cubit, they pass with them by the artery of the arm into the subclavian vein. The external veins have frequent communications with the internal, and are always fullest when we use the most exercise; because the blood being expanded by the heat which exercise produces, it requires the vessels to be distended, and the inner vessels, being compressed by the Actions of the muscles, they cannot dilate enough, but these vessels being seated on the out-sides of the muscles, are capable of being much dilated; and this seems to me to be the chief use of these external vessels. The Cephalick vein as it runs up the arm, is very visible in most men, but in children is rarely to be seen; therefore great care should be taken not to wound it in the cutting of issues in childrens arms; and I know no way to be sure of avoiding it, but by cutting the issue more externally than is usual in men, which may be done without any inconvenience.

IN the Thorax, besides the two Cava's, there is a vein called Azygos or Vena Sine Pari, it is made up of the intercostal, phrenic, and bronchial veins, and enters the descending Cava near the auricle, as if its use was to divert the descending blood from falling too directly upon the blood in the ascending Cava, and direct the blood of the descending Cava into the auricle. Besides this vein in the Thorax, are the mammary veins, one to each Artery; and the veins of the heart which are called Coronariæ; they are twice the



number of the arteries, but they enter the right auricle chiefly at one orifice.

IN the Abdomen, (besides the Cava Ascendens, and the veins which are named like the arteries, viz. The emulgents from the kidneys, the lumbal and spermatick veins, the Sacra, iliac and hypogastrick veins) there is one large one called Vena Portæ, whose branches arise from all the branches of the cœliac and two mesenterick arteries, except the branches of the cœliac and superior mesenterick, which are bestowed on the liver, and uniting in one trunk enters the liver and is there again distributed like an artery, and has its blood collected and brought into the Cava by the branches of the Cava in the liver; this vein being made use of instead of an artery, to carry blood to the liver, for the separation of bile. It moves in this vein about eight times slower than in the arteries hereabouts; and this slow circulation being supposed necessary, I think there could be no other way so fit to procure it; for if an artery had been employed for this use, and been thus much dilated in so short a passage, the blood would not have moved uniformly in it, but much faster through its Axis than near its sides; and besides it is very probable that the blood in this vein having been first employed in nourishing several parts, and having through a long space moved slowly, may be made much fitter for the separation of bile than blood carried by an artery, dilated to procure a circulation of the same velocity with that in this vein.



IN the leg the veins accompany the arteries in the same manner as in the arm, the external veins of the foot being on the upper side, and from them is derived one called Saphœna, which is continued on the inside of the limb its whole length, and has several names given it from the several places through which it passes.

THE arteries are said to have three coats, a middle muscular, and an external and internal membranous. The veins are said to have the same; the internal coat of an artery may be pretty easily separated, but not the external; and though the veins have muscular fibres, yet I could never separate any one distinctly into three coats; and in the inside of the veins there are many valves, especially in the lower limbs, to hinder any reflux of the venal blood, which otherwise would have happened from the frequent actions of the muscles on the outsides of the veins; and both the arteries and veins as they run in the inside of a limb, or as they are dispersed in parts that suffer great extensions, as the stomach, guts and Uterus, they are bent in and out so much as that when these parts come to be distended, they may comply with those distentions, by only being streightened, and so preserved from being stretched, which would lessen their Diameters. The small arteries near the heart go off from the large trunks at obtuse angles, farther at less obtuse angles, then at right angles, farther still at acute angles, and near the extremities at very acute angles, because the blood in the vessels far from the heart moving with less velocity than the blood

in the vessels near the heart, the blood in the collateral branches more remote from the heart wants the advantage of a directer course; and because a very large branch arising out of another, might weaken too much the sides of the vessel it would arise from; that inconvenience is prevented by encreasing the number, and so lessening the size of the collateral branches, where otherwise one large branch would have served better; and in the going off of the subclavian and carotid arteries, which might have gone off for some space in one trunk; but this mechanism is more evident in the going off of the Arteria Coeliaca and Mesenterica Superior. And the small arteries always divide so as that the lesser branch may lie least in the direction of the blood flowing into them, which makes the blood flow most freely into that branch, that has farther to carry it; and the smaller branches arise more or less obliquely, from the sides of other arteries, according to the proportion they bear to the arteries they arise from, because an artery comparatively large arising obliquely from the side of another, would make an orifice in that it arises from too large and weaken it. And both these ends are at once brought about, by making the arteries that give off the branches, bend more or less towards the branches they give off, according to the comparative magnitude of the branches given off.

BORELLI has computed the force which the heart exerts at every Systole, to be equal to three thousand pounds weight, and the force which all the arteries exert at every Systole, to be equal to  
sixteen

sixteen thousand pounds weight, and that they together overcome a force equal to a hundred and thirty six thousand pounds weight; and Dr. Keill has computed that the heart in every Systole, exerts a force not exceeding eight ounces, (but in both these accounts a weight in motion is compared to a weight at rest.) The first computation was made by comparing the heart with other muscles, whose power to sustain a weight could be best determined; and the latter was made from the velocity of the blood moving in an artery: Therefore if we consider that Borelli's way of computing led him to find out the absolute force of the heart, and Dr. Keill's the force which the heart usually exerts, perhaps these very different computations may be accounted for; for if the force of the heart, which is constantly exerted, should, compared with any other muscle, be but in a reciprocal proportion to the frequency of their actions, and the importance of their uses; may not the heart very fitly have a force vastly greater than usually it exerts, because it is always in action, and must be able to exert a certain force in the lowest state of health? What force the heart ever exerts in a growing man, I cannot say; but it must be less in each ventricle than is sufficient to burst the valves, which hinder the blood from returning into the auricles out of the ventricles, or than is sufficient to break those threads by which these valves are tied to the Papillæ. In a dog I found the force which the heart would exert, would not raise to one foot perpendicular height, a column of blood through the Aorta

Ascen-

Ascendens. And when I inject the arteries of a child, I find a force exceeding little will throw water through all the vessels, with a velocity equal to that with which the blood moves in those vessels when living. And if the heart like other muscles can perform the first part of its contraction with most ease, is not the quick actions of the heart in the hectic fevers owing to its not being able to empty the ventricles every Systole, which I think will oblige it to act *Cæteris Paribus* so much the oftner. For the following ingenious attempt to account for the Systole and Diastole of the heart, and the reciprocal actions of the auricles and ventricles, I am obliged to Mr. Monro.

“ *POSTULATA*, that the action of the muscles depends on the influx of blood and *Liquidum Nervosum* into the muscular fibres, and therefore whenever the muscles are deprived of either or both these fluids, their action ceases; this a great many authors have fully proved by tying and cutting the nerves or arteries that serve any muscle. That all muscles are in a constant state of contraction as long as blood and the *Liquidum Nervosum* are freely supplied to them, which seems evident from the *Sphincter Ani* and *Vesicæ*, and from the continued contraction of such muscles, whose antagonists are cut asunder or paralytic. That the nerves of the heart run to it between the auricles and arteries, and that the *Arteriæ Coronariæ* rise from the *Aorta* behind the *Valvulæ Semilunares*, both which are evident from  
dissecti-



“ dissections. If then both auricles and ventri-  
“ cles are ready, upon the first communication  
“ of motion, to contract at the same time, the  
“ ventricles, as Dr. Keil well observes, being  
“ stronger, will first contract and hinder the  
“ contraction of the auricles, which must be in  
“ the mean time, much dilated by the influx of  
“ blood from the veins, while the arteries are  
“ also distended by the blood thrown out of the  
“ ventricles; therefore the cardiack nerves lying  
“ between the two will be compressed, and the  
“ course of the liquids in them stopped; at the  
“ same time the blood that rushes out of the left  
“ ventricle into the Aorta, pushes the valves of  
“ that artery upon the orifices of the Arteriæ  
“ Coronariæ, so that no blood can enter into the  
“ substance of the heart: Thus both causes of  
“ contraction failing, this muscle must become  
“ paralytick. The resistance then to the contra-  
“ ction of the auricles being now removed, they  
“ will throw their blood into the ventricles; and  
“ the impulsion of the blood into the arteries  
“ from the heart now also ceasing, the two great  
“ arteries will be constricted: The nerves are  
“ therefore now again free from compression, and  
“ the valves of the Aorta being thrust back up-  
“ on the mouth of the ventricle, the blood en-  
“ ters the Arteriæ Coronariæ; since the ventri-  
“ cles are again supplied with both the liquids,  
“ on which their contraction depends, they must  
“ again act. And thus as long as these causes  
“ continue, their effects must follow, i. e. as long  
“ as the creature lives, the heart must have an al-  
“ ternate



“ ternate Syftole and Diaftole, and the auricles  
“ and ventricles have reciprocal actions”.

If the arteries contract, fuppofe a fourth part of the fquares of their diameters at every Syftole, and if the heart does not throw out a quantity at every Syftole, equal to the fourth part of the folid contents of all the arteries when dilated, it is evident the heart does not throw the blood through the whole arterial fyftem, but into fo much of the arteries neareft the heart, as will contain four times as much as is thrown out of the left ventricle at once; and then this portion of arteries throws the blood forwards and dilates the arteries that lie next, and fo on: But if the capacities of all the arteries taken together in their utmoft dilations, exceed their capacities in their utmoft contractions, juft fo much as the quantity of blood amounts to, which is thrown out of the left ventricle of the heart at every Syftole, then every contraction of the heart propels the blood through the whole arterial fyftem, and the pulfation of the arteries thus made, will begin at the Aorta immediately after the ventricle begins to contract, and fo go on fucceffively to their extremities; and while the left ventricle of the heart dilates again they will contract, and the times of the Syftole and Diaftole of the heart and arteries always be reciprocal. The fections of all the remoter veffels, being greater than a fection of the Aorta, the blood will move fo much flowier in the leffer veffels than in the greater, as the fections of the leffer veffels taken together, exceed the fection of the greater veffel or veffels. The  
ftrength

strength of the coats of the arteries, if the blood pressed equally against the sides of them all, *Cæteris Paribus*, ought to be one to another as their circumferences, because so much as the circumference of one artery is greater than another, so much greater pressure its sides must sustain; but the arteries nearest the heart, sustaining the reaction of all the arterial blood, they must have a strength yet greater than in that proportion: And the vessels, both arteries and veins, the more distant they are from the head, the greater proportional strength their coats must have, because the arterial and venal blood communicating, they will press upon the lower vessels, with a force proportional to the perpendicular altitude of blood above, which will be that of the perpendicular altitude of the whole body; for tho' the ascending blood of the arteries may be said not to press upon the descending, because it moves another way, nevertheless it being thrown from the heart into one common vessel, which afterwards divides, the blood moving both ways communicates, and that force which is necessary to overcome the natural inclination of the ascending blood to descend, will be impressed also upon the descending blood, which is just the same with the weight of the ascending blood; and the veins both from above and below communicating at the right auricle, the pressure in them will also be as the perpendicular altitude of the body. So that the blood in all the veins and arteries may be compared to a fluid in a curved tube, in which that part in one leg, exactly balances that in the other, and both

7

pressing

pressing most upon those parts which are nearest the center of the earth. Accordingly we find by experience, that humours are more apt to flow to the lowest parts, and that by laying those parts upon a level with the whole body, this inconvenience is remedied; but laying a leg only in a chair does it but in part, just so much as the perpendicular altitude of the body from that part is shortened. There is also to be considered concerning the thickness of the coats of the vessels, that the blood moving slower in the small vessels than in the great, the moment of the blood against the sides of a small vessel, will be as much less than the moment of the blood against equal parts of a great one, as the velocity of the blood of a small vessel is less than that in a great one; and therefore their coats may also differ from the former proportion, as the velocity of the blood differs. Most of the small vessels in the limbs lying against one another are a mutual support, and therefore less liable to be dilated or burst than capillaries which lie in the thin membranes of cavities, such as in the nose. Hence these I suppose are most subject to hæmorrhages. And if hæmorrhages of blood do frequently arise from obstructions in the minutest vessels, does it not appear how opium and the bark, if they thin the blood inwardly taken (as they do most powerfully when mixed with it) come to be so often effectual remedies in that case? And the coats of the lesser vessels being proportionably weaker than the great ones, according to the decrease of the velocity of the blood, which lessens the moment  
with

with which it moves in them, whenever the blood begins to move in them with an equal velocity, or greater, as it happens after an amputation when the great vessels are tied, the force of the blood often overcomes the strength of the coats of the smaller vessels, and dilates them so, that sometimes those vessels, which scarce bled during the operation, will in a few hours bleed vehemently. And this constant effort of the blood to dilate vessels upon the obstructions of others, I take to be one reason of those throbbing pains which are felt in wounds when the bleeding is stopped, and in all violent inflammations, until the collateral branches are dilated, or the tension of the parts otherwise taken off.

THE extreme branches both of the arteries and veins have very numerous communications, like those in the Stamina of the leaves of plants, by which communications the blood that is obstructed in any vessels, may pass off by other vessels that are not obstructed; and since the moment of the blood in the vessels lessens, and the friction from the vessels encreases as it approaches the extremities; and since many of the lesser vessels are more exposed to pressure than any of the large ones, those communications in the lesser vessels are made so much the more numerous. By means of these communications, the blood circulates in a limb that has had part amputated; and into any vessels that have been separated from the trunks that supplied them, which otherwise must have mortified for want of nourishment, and with them for the same reason, all the branch-



es that arise from such separated vessels; and I can discern no other way than by these communications, that the fluids contained in a large inflammation, can suppurate into one cavity.

IF we inject by the arteries a large quantity of a coloured fluid, we find all the large veins full of that liquor, before any of the solid parts are much coloured with it; and upon frequent repetitions all of them much less coloured than I think might be expected, if it had gone into any thing near all the vessels of the body; and I have often thrown wax or tallow coloured with vermilion or verdigrease, through all the arteries, and back again through the veins, even to the heart, every where filling vessels that cannot be discerned without a microscope; and all this without filling or much discolouring any one entire part. In viewing with a microscope the circulation of the blood in the tail of a fish, the eye easily traces arteries to their extremities, and their return in veins; yet all the vessels we can see make but a small part of the whole of what we see; and though we are taught that the whole animal body, is a compages of vessels such as we see: If it were so, I think we could not well distinguish any; and if the sum of the diameters of all the vessels we can see, are to that of the breadths and thicknesses of all the rest of the parts, which we see at the same time, taken together, but as one to five, these vessels then are no more than the twenty fifth part of what we see with them. What then shall we suppose the rest of the tail, and those parts which were so little tinged, and those which were



were not filled with wax, in the foregoing experiments, composed of? Are they not composed of vessels which arise from the arteries, as excretory ducts do in a gland but terminate in the veins? And these vessels being only to convey the nutritious juices, and what else may be a proper vehicle for them, is it not fit the circulation in them should be exceeding slow, that the nutritious particles may adhere the easier to the fibres of the vessels, which they are to augment or repair? Besides, if any whole part was made up of blood vessels, or any other vessels with fluids moving swiftly in them, it seems to me impossible, that one part of a limb can be very cold while another part is hot, if the warmth of the parts is owing to the fluids they contain. And if there are such vessels as these, the velocity of the motion of their fluid will not depend upon any proportion they bear to the vessels they arise from, but upon the velocity with which their fluids are separated from the arteries into them, and the proportion of the sections of all their orifices to the sum of their own sections, at any distance where we would compare the velocity of their fluid. And the strength of the coats of these vessels, may not only be as much less than the strength of the coats of an artery, as their diameters are less, but also less I think in that proportion in which the velocity of their fluids is less, and the motions more uniform, than the velocity and motion of the blood in an artery.

THE coats of the veins are much thinner than those of the arteries, comparing vessels whose

sections are equal, because the blood moving slower in the veins than the arteries, it presses with less moment against their sides: And besides, the blood in the veins has nearly an equal uniform motion, but in the arteries a very unequal one, and that will require a farther difference in the strength of their coats; for those of the arteries must be equal to the greatest natural pressure; and if the arterial blood propels the venal, that is another reason for the different strength of their coats.

ALL these things being considered, it appears to me to be an exceeding difficult thing to determine nearly, what proportion the fluids of an animal body bear to the solids, or to determine what proportion the sum of all the areas of the minutest arteries bear to the Aorta, without which I think we can neither determine the comparative velocity of the blood moving in the different vessels, nor the quantity of blood in any animal body, nor the time in which the whole mass of blood, or a quantity equal to the whole mass is flowing through the heart. But if each ventricle of the heart holds five ounces of blood, and they are filled and emptied every Systole and Diastole, which I think is true, and if eighty pulses in a minute be allowed to be a common number, there then flows twenty five pounds of blood through each ventricle of the heart in a minute. Dr. Keil has shewn that the sum of all the fluids in a man exceed the sum of all the solids, and yet the quantity of blood which all the visible arteries of a man will contain, is less than four pounds; and

and if we may suppose all the visible veins, including the Vena Portæ, hold four times as much, the whole then that the visible vessels can contain, is not twenty pounds; but the whole that they do contain, is but very little more than the veins can contain, seeing the arteries are always found almost empty in dead bodies, but how much the invisible arteries and veins contain, I mean those which contain such a compound fluid, as is found in the larger vessels, I know no way to judge, unless we knew what proportion these vessels bear to those that carry the nutritious juices and Serum, (if there are such) without the Globuli of the blood.

CÆTERIS PARIBUS, is not the velocity of the blood in all animals proportionable to their quantity of action; and is not their necessity of food also in proportion to their quantity of action? If so, we may see how it comes to pass, that animals which use no exercise, and whose blood moves extremely slow in the winter, can subsist without any fresh supply of food, while others that use a little more exercise, require a little more food, and those who use equal exercise winter and summer, require equal quantities of food at all times, the end of eating and drinking, being to repair what exercise and the motion of the blood has destroyed or made useless; and is not the less velocity of the blood in some animals than in others, the reason why wounds and bruises in those animals do not so soon destroy life, as they do in animals whose blood moves swifter?

## C H A P. X.

*Of the lymphæducts.*

**L**YMPHÆDUCTS are small pellucid cylindrical tubes which arise invifible from the extremities of the arteries throughout the whole body, but more plentiful in glands than other parts, and in greateft number from fuch glands as feparate the vifcidest fluids, as may be obferved in the liver and Teftes. They cannot be difcerned in a natural ftate to have more than one coat, and that exceeding thin, having valves at fmall and uncertain diftances, to prevent the regrefs of their fluid. They have frequent communications like the veins, but do not unite fo often; the larger trunks are in many places attended with fmall glands, through which they run, and at the fame time fend communicant branches over them, that they might be fecured againft obftructions from difeafes in thofe glands. They all terminate in the Via Lactea, or in the large veins. All that rife in the Abdomen empty into the Venæ Lactææ Secundi Generis and Receptaculum Chyli; thofe in the cavity of the Thorax into the Ductus Thoracicus and the fubclavian veins. Their uſes are to carry lymph to dilute the chyle, to make it incorporate more readily with the blood (but not to make it flow the better in the Lacteals, as appears fufficiently from their not entering into the  
minu-



minuteſt Laſteals) and to carry off ſo much lymph as is neceſſary to leave the blood in fit temper to flow thro' the veins; for it is always obſerved that in ſuch perſons as have their blood too thin, the Globuli cohere and form *Moleculæ* or polypuſes, which I imagine muſt ariſe from the Globuli of the blood not rubbing often enough, and with ſufficient force one againſt another to diſunit them as faſt as they cohere. Theſe polypuſes are frequently found in all the large veins, and in the right auricle and ventricle of the heart, eſpecially in ſuch bodies as die of chronic diſeaſes.

AUTHORS have hitherto deſcribed and painted theſe veſſels like ſtrings of poppies, as they appear when injected with mercury; becauſe the coat of theſe veſſels being exceeding thin, it is not able any where between the valves to reſiſt the mercury's attracting it ſelf into globules: And the ſame appearance alſo happens when they are preternaturally diſtended; becauſe the valves hindering a diſtention where they are ſeated, the ſpaces between them approach to a ſpherical figure from the equal preſſure of the fluid, according to the degree of their diſtention; but in a natural ſtate when they are filled with lymph, or when they are moderately injected with air or water, they always appear as cylindrical as the veins. Any of theſe veſſels being burſt, they cauſe a dropſy in the cavity into which they open, which is oftener in the Abdomen than the Thorax. This kind of dropſy is ſometimes cured by tapping, and I believe the reaſon why it no oftener ſucceeds is, that it generally takes its riſe from a diſeaſed liver.



liver. Out of a great number that I have opened, I remember but few whose livers appeared perfectly sound; one of which being extraordinary, I will relate his case from his own journal. His way of life exposing him to drink more than he thought could be consistent with his health, he resolved on a sudden to forbear drinking any strong liquors; and this being in winter time, and he catching some colds in stormy weather, he first became rheumatick and then dropsical; and then he came to London for a cure, October 4. 1710. He was tapped by Mr. Ferne, who took away all the water, which was above five gallons; but the Abdomen filling again very fast, he tapped him again, October 28. November 18. December 1. December 30. January 16. and on February 17. Mr. Ferne being indisposed, he was tapped by Mr. William Smith; and on February 24. by Mr. Ferne: On March 17. Mr. Ferne and my self, there being a rupture at the navel, opened that with a launcet, and let out all the water that way, and endeavoured to make a Fistula there to prevent future tapping, but in vain, for when the belly was emptied of water the orifice would close up, he not being able to bear a sponge-tent to keep it open; and on March 24. 1711, we opened it again at the navel with a launcet, and on April 7. Mr. Ferne opened the navel, and again on April 22. at which time there being accidentally present one Mr. Spirling, a barber, who pretending to surgery, and having observed how Mr. Ferne did it, undertook to make the aperture in the same manner, which was by pinching up the skin,

skin, and cutting of it as is usually done in making of issues; this was on April 30. he performed it again in about May 20. and again on June 11. but he not doing it to the captain's satisfaction was after this time discharged, and Mr. Ferne was desired to do the operation again; but the gentleman being farther in the country than Mr. Ferne could conveniently go, I was desired to attend him, which I did afterwards, and tapped him on June 25. July about 4. or 5. July 16. July 26. August 2. August 11. August 18. August 25. September 1. September 8. September 15. and on September 17. the water burst out of it self. I opened it again on September 27. a few days after which he died, after twenty nine times tapping and once opening it self. At all which times he lost above seventy gallons of water. When he was first tapped he was so weak he could scarce sit in a chair; but he soon gathered strength, went into the country, and drove himself in a chaise: About the seventeenth time he drove himself out of the country, and was tapped at my house, and drove himself home immediately after; and at other times would go out immediately after tapping. But for about three weeks before he died, he was almost constantly troubled with rheumatick pains, and bled frequently at the nose, which seemed to be the most immediate cause of of his death.

FORMERLY in this operation only part of the water was drawn off at a time, and the tap sometimes left in the wound to draw off more, which was exceeding painful, and sometimes brought  
on

on a mortification; and if they drew off much water at one time the patient was in great pain, and generally fainted, which was thought to proceed from the loss of too much of the liquor at once. But Dr. Mead observing that these symptoms could not proceed from the loss of an extravasated fluid, soon found the true cause, which was the sudden want of the pressure of the abdominal muscles against the parts contained in the Abdomen; and in the year 1705. being then physician to St. Thomas's hospital, ordered it to be tried there in the following manner: He directed the Abdomen to be pressed by the hands of assistants while the water was running out; and afterwards kept rolled till the muscles recovered force to do their office, and so took out all the water at once without any inconvenience, which has made this operation not very painful, often successful, and never dangerous.

I OPENED a woman who died of a dropfy in the liver, in which I found the gibbous part entirely wasted, and the coat of the liver about a quarter of an inch thick which contained about five gallons of a gross yellowish fluid, in which were many hydatids about the size of gooseberries and some pieces of matter of as bright a red as vermillion. At about fourteen years of age she first began to feel pain in this part which returned monthly, but in time grew continual, her belly constantly encreasing till she died, which was in the twenty eighth year of her age, without ever having had her Menfes. All the other viscera both in the Thorax and Abdomen were perfectly

fectly found, nor was there the least sign of a dropſy in any of the limbs or yellownefs in the ſkin, which is frequent in diſeaſes of the liver.

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## C H A P. XI.

*Of the lymphatic glands.*

THE glands accompanying the lymphatics, are ſituated in the three cavities, in the interſtices of the muſcles, where the lymphatics lie with the large blood veſſels, and in the four e-munctories, viz. the arm-pits and groins. In the brain is ſeated the Glandula Pinealis, which I judge to be of this ſort, having often ſeen large Lymphæducts running into it from the Plexus Choroides; and at the baſis of the brain in the Sella Turcica is the Glandula Pituitaria, into which enters a large lymphatick, as I imagine, named Infundibulum, (Vid. chap. of the brain.) In the neck are ſituated a great many of theſe by the ſides of the carotid arteries and internal jugular veins, and two, or a ſort of double one upon the Larynx immediately below the thyroid cartilage, from which ſituation they derive the name of Thyroideæ, and juſt within the Thorax is ſeated another called Thymus. In very young children the Thymus is as large or larger than the thyroid glands; but in men theſe glands are very large, and the Thymus very ſmall, the former  
having



having encreased in about a double proportion of any other gland of this kind, and the latter having rather diminished than encreased: But in brutes, such as have fallen under my observation, it is just contrary. From which observations I am inclined to conclude, that they both belong to the very same lymphaticks, and that either of them encreasing as much as both ought to do if both encreased, answers the same end as if both did; and that the reason why the Thymus encreases rather than the thyroid glands in brutes, is because the shape of their Thorax affords convenient room for it to lodge in; and that in men the thyroid glands encreased so much, because there is no room in that part of the Thorax where the Thymus is seated for a large gland to be lodged. In dogs, a porpuss, and some other animals, I have seen the lymphaticks in the Thymus and between the Thymus and Ductus Thoracicus full of chyle, and so in many other lymphatics near the Via Lactea. Under the basis of the heart, and at the sides of the lungs, where the great vessels enter, are many of these glands from the size of a pea to that of a hazel nut. In the Abdomen upon the loins near the kidneys, and by the sides of the iliac vessels are many of these glands, which are called Lumbales, and there are some at the hollow side of the liver, named Hepaticæ: And the mesentery is full of glands of a like appearance, but they seem to belong only to the lacteal veins, unless some of them which are seated at the basis of the mesentery among the Venæ Lactææ Secundi Generis, be-  
long



long to the lymphatics that come from the liver, where the hepatic lymphatics pass in their way to the Receptaculum Chyli. The glands which accompany the blood vessels in the limbs are few, and distributed in no certain order; except those in the four emunctories, i. e. in the arm-pits and groins, named Axillares and Inguinales.

BRUTES have some large ones in the thigh, commonly called the pope's-eye; these are seated about the great vessels in the thigh, where they pass through the Triceps muscle. From this situation, and not from any thing extraordinary in these glands it is that wounds are there so dangerous. The lymphatick glands are said by Nuck and others after him, to be composed of vesicles, and not of vessels like other glands; and that these vesicles are repositories of lymph: But from their appearance in a natural state which is very compact and uniform, there seems to me to be but little reason for such a conjecture. Some have thought their use to be by contracting to accelerate the motion of the fluid in the lymphatics; but that does not seem very probable, because a muscular coat would have been the readiest means to produce that effect; besides, these vessels seldom enter any of them without detaching a branch over at the same time perhaps to prevent obstructions. And if these glands were endued with a contracting power, which is only presumed without any proof, it would still be difficult to conceive how such a power applied at uncertain spaces, should not rather obstruct than accelerate the motion of lymph in the lymphaticks,

tics, unless there were valves to prevent a reflux; and even then, if this were a convenient piece of mechanism, it would be very strange, it should no where else in the body be made use of.

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## C H A P. XII.

### *Of the course of the aliment and fluids, abstracted from the foregoing chapters.*

**T**HE aliment being received into the mouth, is there masticated by the teeth, and impregnated with Saliva, which is pressed out of the salivary glands by the motions of the jaw and the muscles that move it and the tongue. (See from page 151 to page 158.)

**T**HEN it descends through the Pharynx into the stomach, where it is digested by the juices of the stomach, (which are what is thrown out of the glands of its inmost coat, and Saliva out of the mouth) and a moderate warmth and attrition. (See from page 161, to page 166.)

**T**HEN it is thrown through the Pylorus or right orifice of the stomach into the Duodenum, where it is mixed with bile from the gall-bladder and liver, and the pancreatic juice, from the pancreatic gland. These fluids serve further to attenuate and dilute the digested aliment, and probably, to make the fluid part separate better from the Fæces. After this it is continually moved by  
the

the peristaltic or vermicular motion of the guts, and the compression of the diaphragm and abdominal muscles, by which forces the fluid parts are pressed into the lacteals, and the gross parts through the guts to the Anus. (See from page 166, to page 168, and from 176, to page 181.)

THE chyle, or thin and milky part of the aliment, being received into the lacteals from all the small guts, they carry it into the Receptaculum Chyli, and from thence the Ductus Thoracicus carries it into the left subclavian vein, where it mixes with the blood, and passes with it to the heart. (See from page 182, to page 187.)

ALL the veins being emptied into two branches, viz. the ascending and descending Cava, they empty into the right auricle of the heart; the right auricle unloads into the right ventricle, which throws the blood through the pulmonary artery into the lungs; from the lungs, the blood is brought by the pulmonary veins into the left auricle, and from that into the left ventricle, by which it is thrown into the Aorta, and distributed through the body. From the extremities of the arteries arise the veins and lymphaticks, the veins to collect the blood and bring it back to the heart, and the lymphatics to return the lymph or thinner part of the blood, from the arteries, to the veins and the Via Lactea, where it mixes with the chyle, and then passes with it into the left subclavian vein and to the heart. (See from page 193, to page 232.)

ALL the fluids that pass into the stomach and guts being carried into the blood-vessels, the  
greatest

greatest part of them are separated and carried off by proper vessels, viz. urine from the kidneys, bile from the liver, &c. and these juices carry along with them whatever might be injurious to the animal Oeconomy. (See from page 182, to page 187.)

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## C H A P. XIII.

*Of the Dura Mater and Pia Mater.*

**D**URA MATER, is a very compact strong membrane lining the inside of the scull, firmly adhering at its basis, and but lightly at the upper part, except at the futures. It has three processes: The first named Falx, begins at the Crista Galli, and runs backwards under the Sutura Sagittalis to the Cerebellum, dividing the Cerebrum into two hemispheres. Its use is said to be, to support one side of the Cerebrum from pressing on the other when the head is inclined to one side. But I think it is evident that this is not the use, because there would be more need of such a process from one side of the scull to the other, than this way; and it would be also very necessary that it should run through the brain, to answer that end. The principal use appears to me to be to divide the brain into such portions as are least liable to be moved in the scull, by any violent motions of the head, which is better done this way than it would the other; and the under-  
side



side of the brain is kept steady by the inequalities of the basis of the scull, which the brain is exactly fitted to. In brutes the Falx is always very small, therefore in those whose brains are of the larger size, as oxen, sheep, horses, &c. the upper part of the scull is made uneven, exactly to fit the folds of the brain, which secures the upper parts of their brains from concussions, in the same manner that the lower parts are secured. The second process runs from the lower and back part of the former to the upper edge of each Os Petrosus, and sustains the posterior lobes of the Cerebrum, that they might not compress the Cerebellum. In such rapacious animals as I have dissected, this process is bone. The third is very small; it runs from the last described process down towards the great Foramen of the scull, and possesses the small space in the Cerebellum between the Processus Vermiformis. These processes of the Dura Mater also serve to keep the brain steady.

THE Dura Mater has in it several sinuses, which are large veins to receive the blood from the lesser veins of the brain: Their number is uncertain, and those that are constant are not described in the same order by writers. The first that presents it self is the Longitudinalis Superior, running from a blind hole a little above the Crista Galli all along the upper edge of the Falx. A transverse section of this vessel is not circular, like other vessels, but a triangle whose sides are arches of a circle; the upper side convex outwards, and the two lower convex inwards. The

P.

figure



figure of this vessel, is preserved by small ligaments running across in the inside that it might not become conical, or cylindrical, like other vessels, from the equal pressure of the contained blood, and thereby incommode the upper edges of each hemisphere of the Cerebrum. On the lower edge of this process is generally another very small one, called *Longitudinalis Inferior*; this runs into the *Rectus*, and when wanting is supplied by a vein; *Rectus* runs between the two first processes of the *Dura Mater*, and unloads with the *Sinus Longitudinalis Superior* into the two lateral sinuses; but for the most part the longitudinal *Sinus* goes more directly into one of the lateral sinuses, and the straight *Sinus* into the other. There is sometimes a small one in the third process, which empties in the same place with the former. From the endings of the longitudinal and straight sinuses, begin the two lateral sinuses, which when they come to the *Os Petrosum*, dip down and pass through the eighth *Foramina* into the internal jugular veins. There is another named *Circularis*, it runs round the forepart only of the *Sella Turcica*; the two ends of this empty into four sinuses, one on the top of each *Os Petrosum*, which pass into the *Sinus Laterales*, and one at the under sides of the same bones, which pass indifferently into both the lateral and cervical sinuses; these two last sinuses have always communicant branches. The cervical sinuses run from the basis of the skull through the great *Foramen* on both sides the *Medulla Spinalis Colli*, and through the transverse processes of

of the cervical Vertebrae; the last of these have many times proper Foramina running from the eighth Foramina to the back-part of the Apophyses of the occipital bone. There are also two more of these vessels, which run from the circular Sinus between the Os Sphenoides and fore-part of the Os Petrosus directly into the internal jugular veins.

PIA MATER, is an exceeding fine membrane immediately investing the brain even between its lobes, hemispheres and folds. It serves to contain the brain, and support its blood vessels, which run here in great numbers, for the arteries to divide into small branches upon, that the blood contained may not enter the brain too impetuously; and for the veins to unite on, that they may enter the sinuses more conveniently. Between the Dura and Pia Mater, is described by several anatomists, a membrane called Arachnoides, which may easily be shewn at the back-part of the Cerebrum, upon the Cerebellum and back-part of the Medulla Spinalis.

I HAVE once seen a large part of the Dura Mater, and once part of the Pia Mater ossified.

## C H A P. XIV.

*Of the Cerebrum, Cerebellum, Medulla Oblongata and Medulla Spinalis.*

CEREBRUM, is that part of the brain which possesses all the upper and fore-part of the Cranium, being separated from the Cerebellum by the second process of the Dura Mater. Its upper side is divided into two hemispheres, and its lower side into four lobes, two called anterior and two posterior, which latter are much the largest. At the meeting of the four lobes, appears the Infundibulum, which seems to be a lymphatic running from the ventricles of the brain into Glandula Pituitaria. This gland is seated in the Sella Turcica. Immediately behind the Infundibulum appear two small bodies, named Protuberantiæ Duæ Albæ Pone Infundibulum. Between the two hemispheres of the Cerebrum, lower than the circumvolutions, appears a white body named Corpus Callosum. Under the Corpus Callosum, appear the two lateral or superior ventricles, which are divided into right and left by a very thin membrane, named Septum Lucidum, which is extended between the Corpus Callosum and Fornix. The Fornix is a medullary body, beginning from the fore-part of these ventricles, with two small roots which soon unite; and running

ning towards the back-part, where they divide into two parts, called Crura Fornicis. In the basis of these two ventricles, are four prominences: The two anterior are called (because of their inner texture) Corpora Striata; the other two are named Thalami Nervorum Opticorum. Beyond these, are two more processes, called Nates: And under them, nearer the Cerebellum, two called Testes. Above the Nates, is situated the Glandula Pinealis, famous for being supposed by Des Cartes, the seat of the soul. And upon the Thalami Nervorum Opticorum, are a number of blood-vessels, glands, and lymphæducts, called Plexus Choroides. Under the beginning of the Fornex, is a small Foramen called Foramen ad Radices Fornicis, or Iter ad Infundibulum. And under the middle of the Fornix, one called Foramen Posterius, which is covered with a valve named Membrana or Valvula Major; and the space under the two anterior ventricles between the Foramina and the Cerebellum, is the third ventricle.

CEREBELLUM, is situated under the second process of the Dura Mater. By dividing this part of the brain length-ways, we discover more plainly the fourth ventricle, whose extremity is called Calamus Scriptorius; here also appear two medullary bodies called Pedunculi, which are the basis of the Cerebellum. The medullary part in the Cerebellum, though it is inmost, as in the Cerebrum, yet is of a different shape, being branched out like a plant.



THE substance of the brain is distinguished into outer and inner; the former is called Corticalis, Cinerea, or Glandulosa, the latter Medullaris, Alba, or Nervea.

MEDULLA OBLONGATA, is a medullary production from the under part of the Cerebrum and Cerebellum: It first appears in two bodies from the anterior part of the posterior lobes of the Cerebrum, called Crura Medullæ Oblongatæ. The union of these Crura between the Cerebrum and Cerebellum, is called Isthmus; and immediately beyond this, is an eminence, named Processus Annularis.

MEDULLA SPINALIS, is a production of the Medulla Oblongata through the great Foramen of the scull, and through the channel of the spine: It enlarges about the last Vertebrae of the back, and first of the neck, where the large nerves are given off to the arms; it again enlarges in the loins, where the crural nerves begin; and the lower end of it with those and other nerves, is called from its resemblance Cauda Equina. The coats of this part are the same with those of the brain; but the membrane here, which is analogous to the Dura Mater, is thinner and more connected to the bones, and the Tunica Arachnoides more conspicuous.

WOUNDS in the Cerebrum, though very dangerous, are not mortal; but in the Cerebellum and Medulla Oblongata, they cause sudden death; and in the Medulla Spinalis, loss of sense in all the parts which receive nerves from below the wound. In persons that have died lethargic, I have



have always found the brain full of water; and in children the brain is always very soft and moist. In a man that died of an apoplexy, I found all the vessels of the brain immoderately distended with blood, and the ventricles and the substance of the brain full of lymph, and the Pia Mater very much thickened, and adhering so very loosely, that the greatest part of it was separated without breaking.

I HAVE twice seen in the Cerebrum a schirous tumour as large as a pullet's egg; and in another body, imposthumations which possessed near two thirds of the whole Cerebrum. And in a person that died with a Gutta Serena, I found all the ventricles of the brain full of lymph; and the Thalami Nervorum Opticorum and the optick nerves, e'er they went out of the scull, made flat with the pressure. And in an old man I found the right optick nerve wasted, and black.

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## C H A P. XV.

*Of the nerves.*

“ FROM the medullary part of the Cerebrum,  
“ Cerebellum, and Medulla Spinalis, a  
“ vast number of small medullary white fibres  
“ are sent out, which, at their first egress, seem  
“ easily to separate, but as they pass forward are  
“ somewhat more, but still loosely connected, by  
“ the coat which they obtain from the Pia Ma-

ter, and at last piercing the Dura Mater, are  
 straitly braced by that membrane which covers  
 them in their progress; whence they become  
 white, firm, strong cords, and are so, well  
 known by the name of nerves. To these coats  
 an infinite number of vessels, both arteries and  
 veins are distributed; so that after a nice, lucky  
 injection the whole cord is tinged with the co-  
 lour of the injected liquor; but when the fibrils  
 are examined, even with the best microscope,  
 they appear only like so many small distinct  
 threads running parallel, without any cavity  
 observable in them, though some incautious  
 observers, mistaking the cut orifices of the ar-  
 terious and venous vessels, just now mentioned,  
 for nervous tubes, have affirmed their cavities  
 to be visible. The nerves, which if all joined,  
 hardly make a cord of an inch diameter, would  
 seem from their exerting themselves every where,  
 to be distributed to each, even the smallest  
 part of the body. In their course to the pla-  
 ces for which they are destined they generally  
 run as strait, as the part over which they are  
 to pass, and their own safety from external in-  
 juries will allow, sending off their branches at  
 very acute angles, and consequently running  
 more parallel than the blood vessels. Their di-  
 stribution is seldom different in the opposite  
 sides of the same subject, nor indeed in any  
 two subjects is there considerable variety found.  
 Frequently nerves which come out distinct or  
 separate, afterwards conjoin into one Fascicu-  
 lus, under the same common covering; and  
 though

“ though the nervous fibrils probably do not  
“ communicate, (the reason of which opinion  
“ shall immediately be given) yet because the  
“ coats, at the conjoined part are common, and  
“ these strong coats may have great effects on the  
“ soft pulpy nerves, it is evident all such will  
“ have a considerable sympathy with one another,  
“ whereof several examples in practice shall be  
“ instanced when the particular nerves are de-  
“ scribed. In some parts where there are such  
“ conjunctions, the bulk of the nerves seems  
“ much increased, and these knotty oval bodies,  
“ called by Falloppius Corpora Olivaria, and ge-  
“ nerally now named ganglions, are formed; the  
“ coats of these knots are stronger, thicker, and  
“ more muscular, than the whole nerves which  
“ enter into them would seem to constitute, while  
“ the nervous fibrils pass through without any  
“ great alteration or change. I do not think any  
“ author has yet made a probable conjecture of  
“ the use or design of these ganglions, whether  
“ they imagine them Corcula Expellentia, reser-  
“ voires, or elaboratories, neither can I give an  
“ account of their use the least satisfactory to  
“ my self.

“ FROM undeniable evident experiments, all  
“ anatomists are now convinced that to the  
“ nerves we owe all our sensation and motion,  
“ of which they are proper organs; and the sen-  
“ sations in the minutest parts being very distinct,  
“ therefore the instruments of such sensations  
“ must have distinct origins and course to each  
“ part

“ part. Though all are agreed as to the effect,  
“ yet a hot dispute has arose about the manner  
“ how it is produced, viz. whether sensation and  
“ motion are occasioned by a vibration commu-  
“ nicated to the nerves, which these gentlemen  
“ suppose entirely solid and tense, or by a liquid  
“ contained and moved in them. The last of  
“ these opinions I rather incline to for these rea-  
“ sons, because the nerves proceeding from the  
“ brain bear a great analogy to the excretory  
“ ducts of other glands. Then they are far from  
“ being stretched and tense in order to vibrate:  
“ And what brings the existence of a liquid in  
“ their cavities next to a demonstration, is the  
“ experiment first made by Bellini, and related  
“ by Bohn and Pitcairn, which I have often done  
“ with exact good success; it is this: After o-  
“ pening the Thorax of a living dog, catch hold  
“ of and compress the phrenick nerve, immedi-  
“ ately the diaphragm ceases to act; remove the  
“ compressing force, that muscle again contracts;  
“ gripe the nerve with one hand some way above  
“ the diaphragm, that Septum is unactive; then  
“ with the other hand strip down the nerve from  
“ the first hand to the diaphragm, this muscle a-  
“ gain contracts; after once or twice having strip-  
“ ped the nerves thus down, or exhausted the li-  
“ quid contained in it, the muscle no more acts,  
“ squeeze as you will, till the first hand is taken  
“ away or removed higher, and the nerve strip-  
“ ped, i. e. the liquids in the superior part of the  
“ nerve have free access to the diaphragm, or are  
“ forced down to it, when it again will move.

“ Now



“ Now if this liquid should be granted to us, I am  
“ afraid we shall be still as much at a loss to ac-  
“ count for sensation and motion as ever; and  
“ therefore all I shall assume is what is founded  
“ on experiments, that these two actions do de-  
“ pend on the nerves; that sensations are pleasant  
“ as long as the nerves are only gently affected  
“ without any violence offered them; but as soon  
“ as any force applied goes beyond this, and  
“ threatens a solution of union, it creates that un-  
“ easy sensation pain; that the nerves, their  
“ source, or their coats being vitiated either con-  
“ vulsion or palsy of the muscles may ensue,

“ THE nerves are distinguished into two clas-  
“ ses, of the Encephalon and Medulla Spinalis;  
“ of the first there are generally ten pair reckon-  
“ ed, of the last thirty. I shall describe the  
“ nerves in the same order in which they are ge-  
“ nerally ranked, though it is not possible to pro-  
“ secute the dissection of them after the same  
“ manner; but to supply this, I shall mention al-  
“ so the order wherein they may be all demon-  
“ strated on one subject. When I assign the ori-  
“ gin of any nerve from any particular part, I de-  
“ sire it may be understood of that part of the  
“ surface of the Medulla where the nerve first ap-  
“ pears; for by this method we will shun any dis-  
“ pute with those authors who trace their rise  
“ too minutely, and perhaps be less liable to mis-  
“ take or to deceive our readers. Nor shall I be  
“ over anxious about the terminations of the Mi-  
“ nimæ Fibrillæ, since it is not possible to trace  
“ them Ad Ultimos Fines, nor do I think very

“ neces-



“ necessary for explaining any Phænomena, while  
 “ very often in a multiplicity of words, the whole  
 “ description comes to be obscure or unintelli-  
 “ gible.

“ OF the ten pair proceeding from the Ence-  
 “ phalon, the first is the olfactory, which in  
 “ brutes, justly enough, has the name of Proces-  
 “ sus Mammillares bestowed on them, being large  
 “ and hollow, and are indeed evidently the two  
 “ anterior ventricles of the brain produced; which  
 “ structure, and the lymph constantly found in  
 “ them, induced the antients to believe that they  
 “ served as emunctories to convey the supera-  
 “ bundant Mucus from the cold moist brain to  
 “ the nose; but in man they are small, long, and  
 “ without any cavity, rising from that part of the  
 “ brain where the carotid arteries are about to  
 “ enter, and running under the anterior lobes of  
 “ the brain become a little larger, till they reach  
 “ the Os Cribriforme, into the Foramina, of  
 “ which the small filaments insinuate themselves,  
 “ as upon gently pulling those nerves or after  
 “ having cut them very near the bone is evident,  
 “ and are immediately spread on the Membrana  
 “ Narium. Their tender structure and sudden  
 “ expansion on such a large surface, make it im-  
 “ possible to trace them on the membrane of the  
 “ nostrils, which has given some handle to sever-  
 “ al authors to deny them the structure or use of  
 “ nerves.

“ THE second are the optick, which arise sin-  
 “ gle from the Thalami Nervorum Opticorum,  
 “ and then uniting at the fore-part of the Cella

“ Turci-

“ Turcica, they seem to be pretty much blend-  
“ ed; afterwards they divide, and running ob-  
“ liquely forwards, pass out at their proper hole  
“ of the sphenoid bone, and enter the globe of  
“ the eye to be expanded into the Membrana  
“ Retina. From this conjunction of these nerves,  
“ authors generally endeavour to account for our  
“ seeing objects single, whereas we have reason  
“ to believe fishes, the chameleon, &c. whose  
“ optick nerves simply cross one another without  
“ any such union, do see objects also single,  
“ since they so exactly rush on their prey; where-  
“ as, if those authors assertions were true, they  
“ would oftener catch at the shadow than the  
“ substance. The blood vessels running through  
“ the middle of these nerves, and the ramificati-  
“ ons of the Retina are very observable, whence  
“ we may deduce the reason of Picard’s experi-  
“ ment of such objects as fall on the entry of the  
“ optick nerve being lost to us, and hence also  
“ an account may be given of an Amaurosis or  
“ Gutta Serena.

“ THE third pair of nerves first appear at the  
“ anterior part of the Processus Annularis, and  
“ and going out at the Foramen Lacerum are di-  
“ stributed to the globe of the eye; Musculus  
“ Rectus Fallopii, Attollens, Adducens, Depri-  
“ mens, and Obliquus Minor; therefore this  
“ pair has justly got the name of Motores O-  
“ culi.

“ THE fourth pair, which are the smallest of  
“ any, derive their origins from the anterior la-  
“ teral part of the Processus Annularis, and go  
“ out

“ out at the Foramina Lacera to be entirely spent  
 “ on the Musculi Trochleares, or Obliqui Majo-  
 “ res Oculorum, to which muscles chiefly the  
 “ rotatory motion of the eyes in ogling and the  
 “ advance of the eyes forward in staring, and fu-  
 “ ry, is owing; for which reason anatomists have  
 “ called these nerves Pathetici.

“ THE fifth pair rise from the sides of the an-  
 “ nular process, and after piercing the Dura Ma-  
 “ ter divide into three branches; the first of which  
 “ is the Ophthalmick, which as it is about to enter  
 “ the orbit by the Foramen Lacerum, sends off  
 “ a small twig that assists in the formation of the  
 “ intercostal, and then the nerve is distributed  
 “ to the Glandula Lacrymalis, fat, membranes,  
 “ and Palpebræ of the Eye, while it sends one  
 “ considerable branch through the Orbiter Inter-  
 “ nus Anterior hole to be lost in the Membrana  
 “ Narium, and a second passes the Foramen and  
 “ Supercilia to supply the muscles and teguments  
 “ of the forehead. Hence we easily discover  
 “ what part is affected in that painful disease the  
 “ megrim, when the eye-ball and forehead are  
 “ racked, and such a heat is felt within the nose:  
 “ Hence also we may learn how the muscles of  
 “ respiration come to be so much affected on the  
 “ application of any acrid irritating substance to  
 “ the Membrana Narium, as to produce that  
 “ violent convulsive motion, sneezing. The se-  
 “ cond branch of the fifth pair, which may be  
 “ called Maxillaris Superior, passes out through  
 “ the Foramen Rotundum Ossis Sphenoidis, and  
 “ immediately gives the nerves to the fat under

“ the

“ the crotaphyte muscle, and to the palate, Si-  
“ nus Sphenoidalis and nostrils. The remain-  
“ ing trunk insinuating it self into the channel  
“ on the top of the Antrum Highmorianum,  
“ to which cavity and to the teeth of the upper  
“ jaw it gives small twigs, at last comes out at  
“ the Orbiter Externus hole, and is spent on the  
“ Musculus Orbicularis Palpebrarum, nose and  
“ upper lip, where some branches of the seventh  
“ pair seem to unite themselves to the twigs of  
“ this. The third branch or Maxillaris Inferior  
“ goes out at the Foramen Ovale, or fourth hole  
“ of the wedg-like bone, and soon splitting into  
“ a great many branches, is distributed to the  
“ Musculus Crotaphites, Masseter, Pterygoides,  
“ Digastricus, Buccinator, Mylohyoideus, Ge-  
“ niohyoideus, Genio-glossus and Basio-glossus,  
“ Glandula Sublingualis, Maxillaris Inferior, and  
“ Parotis, to the external ear where it seems to  
“ join the Portio Dura to the substance of the  
“ tongue, in which it is pretty much confounded  
“ with the ninth pair: From the root of this last  
“ branch the Chorda Tympani is reflected. The  
“ last ramification of this branch which I shall  
“ mention, is that which enters into the canal of  
“ the lower jaw, furnishes the teeth there, and  
“ comes out at the chin, on which and the lower  
“ lip it is bestowed; at this place it is again con-  
“ joined to the seventh pair. From this short  
“ sketch of the large fifth pair of nerves, and by  
“ observing several Phænomena which happen to  
“ those parts to which they are distributed, we  
“ might have a much farther confirmation of the



“ general doctrine of nerves delivered, and see,  
 “ at least, the way pathed to a rational account  
 “ of these Phænomena, for reasoning of which  
 “ we should not otherwise have the least ground.  
 “ We can, for example, from the Chorda Tym-  
 “ pani and the nerves of the teeth being derived  
 “ from the same common trunk, understand how  
 “ the sound of any vibrating body held between  
 “ our teeth is sensible to us, when another can-  
 “ not possibly hear the least on’t. By the like  
 “ rule we know why in a violent tooth-ach the  
 “ muscles of the face are sometimes convulsed ;  
 “ nor shall we be surprized to hear one plagued  
 “ with the ach in his upper teeth, complain of a  
 “ gnawing pain deep seated in the bones of his  
 “ face, or to see his eyelids much swelled, or  
 “ the tears trickling down in great abundance ;  
 “ whereas the lower teeth aching, the ear is  
 “ pained, and the Saliva flows in great quanti-  
 “ ties. We may have some distant views of some  
 “ foundation in reason for the cure of the tooth-  
 “ ach, by strong compression of the chin, or by  
 “ applying blisters behind the ears, or by burning  
 “ behind or on the ear. Among a great many  
 “ instances of the good effect of the actual cau-  
 “ tery in such a case, I shall give one which seems  
 “ to me remarkable. I. M. was seized with the  
 “ tooth-ach, a convulsion of that whole side of his  
 “ face followed whenever the pain became acute,  
 “ or he attempted to speak ; after he had under-  
 “ gone bleeding, purging, salivation, setons, &c.  
 “ without any benefit, he was cured by applying  
 “ a small cauterising iron to the Antihelix.



“ THE sixth pair of nerves arising from the  
“ fore part of the Corpora Pyramidalia, after  
“ piercing through the Dura Mater, give off a  
“ branch, which joined with the reflected twig  
“ of the ophthalmick branch of the fifth pair,  
“ forms the original of the intercostal, passes  
“ through the Foramen Lacerum to be spent en-  
“ tirely on the Musculus Abductor Oculi, sup-  
“ posing this nerve to supply ever so little less  
“ than a due proportion of Liquidum Nervo-  
“ sum, an involuntary Strabismus will be occa-  
“ sioned.

“ THOUGH the fifth and sixth pair of nerves  
“ form entirely the beginning of the inter-  
“ costal before it goes out of the scull, yet be-  
“ cause several other nerves contribute towards  
“ the formation of its trunk before it sends off  
“ any branches, I shall supersede the description  
“ of it till the original nerves are spoke to.

“ THE seventh pair appears coming out from  
“ the side of the root of the annular process,  
“ and entering the Meatus Auditorius Internus,  
“ and immediately dividing one part, soon loses  
“ its firm coats, and is expanded on the inmost  
“ Camera of the ear, while the other passing  
“ through the Aquæductus Fallopii comes out of  
“ the scull involved in all its coats between the  
“ styloide and mastoide processes; whence we  
“ see the reason of the first being named Portio  
“ Mollis, and the other Dura: This last after  
“ its exit supplies the Musculi Obliqui Capitis  
“ Stylohyoidei, Styloglossi and Stylopharyngei,  
“ and Platysma Myoides, on which and to the

“ skin of the neck, a great number of its small  
 “ filaments run, which are sometimes cut in open-  
 “ ing the jugular vein, whence pain at first, and  
 “ a little numbness afterwards. The superior  
 “ branches of it supply the parotid gland, exter-  
 “ nal ear and whole side of the face as far for-  
 “ wards as the chin. It is said to communicate  
 “ thrice with the fifth pair, and twice with the se-  
 “ cond vertebral. May we not from hence see  
 “ some reason why the head is so soon moved  
 “ by the impression of sound on our ear?

“ THE eighth pair of nerves derive their ori-  
 “ gin from the side of the basis of the Corpora  
 “ Olivaria, where their loose filamentous texture  
 “ is very conspicuous; then running to the hole  
 “ common to the Ossa Temporum and Occipitis,  
 “ they are there joined by the Accessorius Wil-  
 “ lisii, which has its beginning from the two or  
 “ three superior nerves of the Medulla Spinalis,  
 “ and mounts upwards thither, to pass out with  
 “ the eighth pair, at that common Foramen just  
 “ now mentioned: Very soon after they, wrap-  
 “ ped up in the same coat, have got out of the  
 “ Cranium, the Accessorius separates from its  
 “ companion, and after passing through the  
 “ middle of the Musculus Mastoideus is lost in  
 “ the Musculus Trapezius and Rhomboides Sca-  
 “ pulæ. While the large trunk, which from the  
 “ great number of branches it sends off obtains  
 “ the name of Vagus, runs strait down the neck,  
 “ near the carotid artery, in its course giving se-  
 “ veral branches to the Larynx: When entered  
 “ the Thorax it splits into two; the anterior  
 serves

“ serves the Pericardium, sends branches to join  
“ with those of the intercostal that go to the  
“ heart, and then on the right side turns round  
“ the subclavian, and on the left round the great  
“ curvature of the Aorta to mount again up-  
“ wards on the side of the Œsophagus to be lost  
“ in the Larynx. This recurrent branch it is that  
“ we are earnestly cautioned to avoid in Broncho-  
“ tomy, though by reason of its deep situation  
“ we are in no hazard of it. If both these nerves  
“ were cut, it is probable the voice would not  
“ be entirely lost as long as the superior branches  
“ still supply the Larynx. The posterior branch  
“ of the eighth pair goes along with the Œsopha-  
“ gus, and supplies the lungs, the Gula and sto-  
“ mach very plentifully : And as all the nerves  
“ bestowed on this Viscus enter at the superior  
“ orifice of it; the sensation here must be very  
“ acute; whence Helmont imagined the mouth  
“ of the stomach to be the seat of the soul. What  
“ remains of this Par Vagum is adjoined to the  
“ intercostal immediately below the diaphragm.

“ The ninth pair appears first at the inferior  
“ part of the Corpora Pyramidalia, and march  
“ out at their proper holes of the Occipitis, and  
“ after sending off some nerves to the Glandula  
“ Thyroidea, and Musculi Sterno-Hyoidei, and  
“ Sterno-Thyroidei, are lost in the substance of  
“ the tongue. Authors have disputed whether  
“ this ninth or the fifth is the gustatory nerve ;  
“ the old opinion in favour of the ninth is to me  
“ most probable, because the fifth is no where  
“ else employed as an organ of sensation, because

“ the ninth seems to penetrate the substance of  
 “ the tongue more, while the fifth is spent on the  
 “ muscles.

“ THE tenth pair comes out from the begin-  
 “ ning of the Medulla Spinalis betwixt the Os Oc-  
 “ cipitis and first Vertebra Colli, and is all, except  
 “ what goes to the ganglion of the intercostal,  
 “ spent on the Musculi Obliqui, and Extensores  
 “ Capitis.

“ THE only nerves proceeding from the En-  
 “ cephalon not described, are the reflected  
 “ branches of the fifth and sixth, which indeed  
 “ are so small and pappy, and hid by the carotid  
 “ artery as they go out with it in its crooked  
 “ canal, as not to be easily traced, but whenever  
 “ they have escaped from the Os Petrosum they  
 “ are joined by branches from the eighth, ninth,  
 “ tenth, and first and second spinal; and the  
 “ largest ganglion of the body is formed, from  
 “ which the nerve named now intercostal goes  
 “ out to descend down the neck with the caro-  
 “ tid, supplying in its course the Musculi Flexo-  
 “ res of the head and neck, and communicating  
 “ with the cervical nerves. As the intercostal is  
 “ about to enter the Thorax, it again forms a  
 “ ganglion, from which nerves to the Trachea  
 “ Arteria and the heart are supplied, which join  
 “ with the branches of the eighth, and pass be-  
 “ tween the two large arteries and auricles to the  
 “ substance of that muscle. Now let any one  
 “ consider the egress of the intercostal, and close  
 “ course of it and the eighth with the carotid ar-  
 “ tery, and this manner of entry of the cardiac  
 “ nerves,



“ nerves, surely the alternate constriction and relaxation of the heart will appear necessarily depending on the disposition of these organs of motion, the nerves. The intercostal after this runs down on the side of the *Vertebræ Thoracis*, having additional nerves constantly sent to it from between these *Vertebræ*, till it pass through its own proper hole of the diaphragm; whence it again forms another ganglion close by the *Glandulæ Renales*, into which the eighth pair enter. From such a knot on each side, the nerves of the guts, liver, spleen, *Pancreas* and kidneys are derived, nay the extremity of this nerve is sent down to the *Pelvis* to supply the parts there. Hence the great sympathy of these parts may be easily deduced, and a reason may be given of the violent vomiting that commonly attends a *Nephritis*, and of the belching cholicks and stomach-achs, which often ensue on the obstructions of the *Menstrua*.

“ BEFORE I proceed to the spinal nerves, I shall set down the order in which these nerves already described, are to be dissected in order to demonstrate them all in one subject, but to them must assume the three first cervical nerves, the reason of which will be evident afterwards.

“ *PORTIO Dura septimi, Frontalis quinti, Facialis quinti, Mentalis quinti, Spinalis secundus, Spinalis primus, Olfactorius, Ophthalmicus quinti, Motorius Oculi, Patheticus sextus, Opticus, Maxillaris inferior quinti, Maxillaris su-*

“ perior quinti, Accessorius Willisii, nonus, decimus, octavus Intercoſtalis, Portio Mollis ſeptimi,

“ THE thirty pair of nerves proceeding from the Medulla Spinalis, are generally divided into four ſpecies, of the neck ſeven, of the back twelve, of the loins five, and of the Os Sacrum fix. Now as the Medulla Spinalis has none of theſe inequalities ſo obſervable on the Medulla Oblongata Encephali, the riſe of the nerves is not ſo accurately deſcribed, being only determined by the bones through which they paſs.

“ THE firſt cervical goes out between the firſt and ſecond Vertebra, and, after ſending off branches that communicate with the tenth and ſecond Vertebrale, is ſpent on the Muſculus Flexus Colli, Splenius, Complexus, and teguments of the Occipitis.

“ THE ſecond cervical communicates with the ninth, and with the firſt and third of the neck, and then is diſtributed to the Teguments of the neck and ſide of the head, and to the Glandula Parotis and external ear, where it joins with the Portio Dura.

“ THE third of the neck paſſes out between the third and fourth Vertebra, ſoon communicating with the ſecond, and ſending down a large branch, which being joined by another from the fourth forms the phrenick nerve that runs along the Pericardium to be loſt in the diaphragm. In this courſe the right phrenick is obliged to make a ſmall turn round that part of the Pericardium which covers the Apex of  
“ the

“ the heart. Hence it is, that such as have  
“ strong palpitations of the heart, feel a pungent  
“ acute pain immediately above the right orifice  
“ of the stomach. The other branches of this  
“ third cervical are distributed to the *Musculus*  
“ *Trapezius* and *Deltoides*, and to the tegu-  
“ ments on the top of the shoulder; which,  
“ with the description of the eighth pair, leads  
“ us evidently to the reasons of the divine Hip-  
“ pocrates’s observation, that an inflammation of  
“ the liver is generally attended with a hick-up,  
“ and a suppuration of that *Viscus* with a violent  
“ pain on the top of the shoulder. However  
“ we are not hence to conclude so generally as I  
“ have observed physicians frequently do, that  
“ if the *Hypochondria* are affected, and this pain  
“ of the shoulder is felt, therefore the liver is  
“ suppurated, for any other cause stimulating or  
“ stretching the nerves, such as inflammation,  
“ wounds, scirrhous or steatomatous tumors, &c.  
“ may produce the same effect.

“ THE fourth cervical, after sending off that  
“ branch which joins with the third to form the  
“ phrenick, runs strait to the *Axilla*, where it  
“ meets with the fifth, sixth and seventh cervi-  
“ cals, and first dorsal that escape in the intersti-  
“ ces of the *Musculi Scaleri*; and all of them  
“ are so often conjoined and blended, after they  
“ have given off nerves to the muscles of the  
“ neck, scapula, arm, and *Thorax*, and to the  
“ teguments, that when the several ramifications  
“ go off in the *Axilla* to the different parts of  
“ the superior extremity, ’tis impossible to de-

“ termine which of them the branches belong to.  
 “ The considerable branches into which they are  
 “ divided are six; these I shall presume to give  
 “ proper distinguishing names to, by which the  
 “ description will be less confused, and the young  
 “ anatomist’s memory better assisted to retain  
 “ what is so difficult to represent in words.

1. “ CUTANEUS runs down the fore-part of  
 “ the arm, and serves the teguments, as far as  
 “ the palm of the hand and fingers.

2. “ MUSCULO-CUTANEUS, or Perforans  
 “ Casserii passes through the Musculus Coraco-  
 “ Brachialis, and after supplying the Biceps and  
 “ Brachæus Internus, is spent on the teguments  
 “ of the back of the Cubitus and hand.

3. “ MUSCULARIS, that runs down the fore  
 “ part of the arm to be lost in the Musculi Flex-  
 “ ores Carpi, Digitorum, &c.

4. “ ULNARIS, which supplies the Extensor-  
 “ es Cubiti, and teguments of the elbow, and  
 “ then passing through the sinuosity at the back  
 “ of the external condyle of the Humerus, runs  
 “ along the Ulna, where it gives twigs to the  
 “ teguments and neighbouring muscles, at length  
 “ is lost in the back of the hand, Musculi Inter-  
 “ ossei and Lumbricales in the little finger, and  
 “ side of the ring-finger next to this. The course  
 “ of this nerve is sufficiently felt when we lean on  
 “ our elbow, by the insensibility and prickling  
 “ pain in the parts to which it is distributed.

5. “ RADIALIS, goes down the fore part of  
 “ the arm near the Radius, bestowing branches  
 “ in its progress on the circumjacent muscles,  
 “ and



“ and at the Ligamentum Annulare Carpi splitting, is sent to the thumb, fore finger, middle finger, an half of the ring finger, and to the back of the hand.

6. “ *ARTICULARIS* runs almost round the top of the *Os Humeri*, and serves the *Musculi Extensores Cubiti, Retractores* and *Elevatores Humeri*.

“ By a strong and continued pressure on these nerves, by crutches, or any such hard substance a palsy and atrophy of the arm may be occasioned.

“ *THE* twelve dorsal nerves all communicate with one another; as soon as they make their way out betwixt the *Vertebræ*, each of them gives a posterior branch to the *Musculi Erectores Trunci Corporis*; the first, after having sent off the brachial nerve, already described, is after the same manner, with the succeeding eight, bestowed on the *Pleura* and intercostal muscles, the tenth and eleventh are most of them sent to the abdominal muscles, the twelfth communicates with the first lumbar, and is bestowed on the *Musculus Quadratus Lumbalis* and *Iliacus Internus*.

“ *THE* fifth lumbar also communicates and gives posterior branches; the first sends several branches to the abdominal muscles, and *Psoas* and *Iliacus*, while others go from it to the teguments and muscles on the superior and anterior part of the thigh, and the main trunk of it is lost in the crural. The second passes thro’ the *Psoas* muscle, and is distributed much as the  
“ former.

“ former. The third is lost in the Musculus Pe-  
 “ ctineus. Branches proceeding from the first,  
 “ second and third make up one trunk, which  
 “ runs along the anterior part of the Pelvis, and  
 “ slipping through a small sinuosity in the ante-  
 “ rior part of the Foramen Magnum Ossis Ischii,  
 “ is spent in the Musculus Triceps. This nerve  
 “ is commonly known by the name of Obtura-  
 “ tor, or posterior crural nerve. By the union  
 “ of branches from the first, second, third, and  
 “ fourth lumbar nerves, the anterior crural nerve  
 “ is formed, which running along the Musculus  
 “ Psoas, escapes with the large blood-vessels out  
 “ of the Abdomen below the tendinous arcade  
 “ of its muscles, and is distributed to the muscles  
 “ and teguments on the fore part of the thigh :  
 “ One branch of this crural nerve accompanies  
 “ the Vena Saphena as far as the ankle. Now let  
 “ us imagine the situation of the kidney upon,  
 “ and the course of the Ureter over these nerves,  
 “ and we shall not be surprized, that in a Ne-  
 “ phritis, the trunk of the body cannot be raised  
 “ erect without great pain ; that the thigh loses  
 “ of its sensibility, and that it is drawn forwards.  
 “ The remainder of the fourth and the fifth lum-  
 “ bar nerves join with the first, second, and third  
 “ that proceed from the Os Sacrum : These five,  
 “ when united, constitute the largest nerve of  
 “ the body, so well known by the name of the  
 “ sciatic, or ischiatic nerve, which seems to be  
 “ bigger, in proportion to the part for the use  
 “ of which it is, than the nerves of any other  
 “ part are ; the design of which may be to af-  
 ford

“ford sufficient strength to the muscles of the  
“lower extremity, for exerting a force superior  
“to what is required in any other part of the bo-  
“dy. When this nerve is any way obstructed,  
“we see how unable we are to support our selves,  
“or to walk. The sciatic nerve then goes out  
“at the large hollow, behind the great tubercle  
“of the Os Ischium, and passing over the Qua-  
“drigemini muscles, runs down the posterior  
“part of the thigh, giving off, every where as  
“it goes, nerves to the teguments and muscles  
“of the thigh and leg. At the ham it splits in-  
“to two; the smaller mounts over the Fibula,  
“and serving the Musculi Peronei, Flexores Pe-  
“dis, and Extensores Digitorum, is continued  
“to the toes along the broad of the foot, while  
“the larger trunk sinks under the Musculi Ge-  
“melli, and then divides; one is spent on the  
“muscles at the back of the leg and teguments,  
“while the other is continued by the inner an-  
“cle to the foot, and then subdivides; one  
“branch is distributed after the same manner as  
“the Ulnaris, and the other as the Radialis in  
“the hand.

“THE other nerves that come of the Os Sa-  
“crum are sent to the organs of generation, Mus-  
“culi Levatores Ani and Obturatores.

“THESE nerves of the Medulla Spinalis may  
“all be dissected and demonstrated in the same  
“order in which they are described.”

THE nerves seem, when examined with a mi-  
croscope, to be bundles of strait fibres not  
communicating with one another: And I am in-  
clined

clined to think that every the minutest nerve, terminating in any part, is a distinct cord from its origin in the brain, or spinal marrow; or else I do not see how they could produce distinct sensations in every part; and the distinct points of sensation throughout the body are so very numerous, that the whole body of nerves (which taken together would not make a cord of an inch diameter) must be divided into such a number, to afford one for every part that has a distinct sensation, that surely such a nerve would be too small to be seen by the best microscope. They all pass in as direct courses to the places they serve as is possible, never separating nor joining with one another but at very acute angles, unless where they unite in those knots which are called ganglions, the use of which I do not pretend to know; they make what appears to be a communication of most of the nerves on the same side, but never join nerves of opposite sides.

THAT the nerves are instruments of sensation, is clearly proved from experiments, but how they convey those sensations to the brain, is matter of great dispute. The most general opinion is, that they are tubes to contain animal spirits, by whose motions these sensations are conveyed: And diligent enquiry has been made to discover their cavities, but hitherto in vain; and if each nerve is distinct from its origin, as I have endeavoured to shew, and too small to be the object of the best microscope, I do not see how such cavities are like to be discovered. However, I think the nerves may be tubes, and that a fluid, whose co-  
hesion



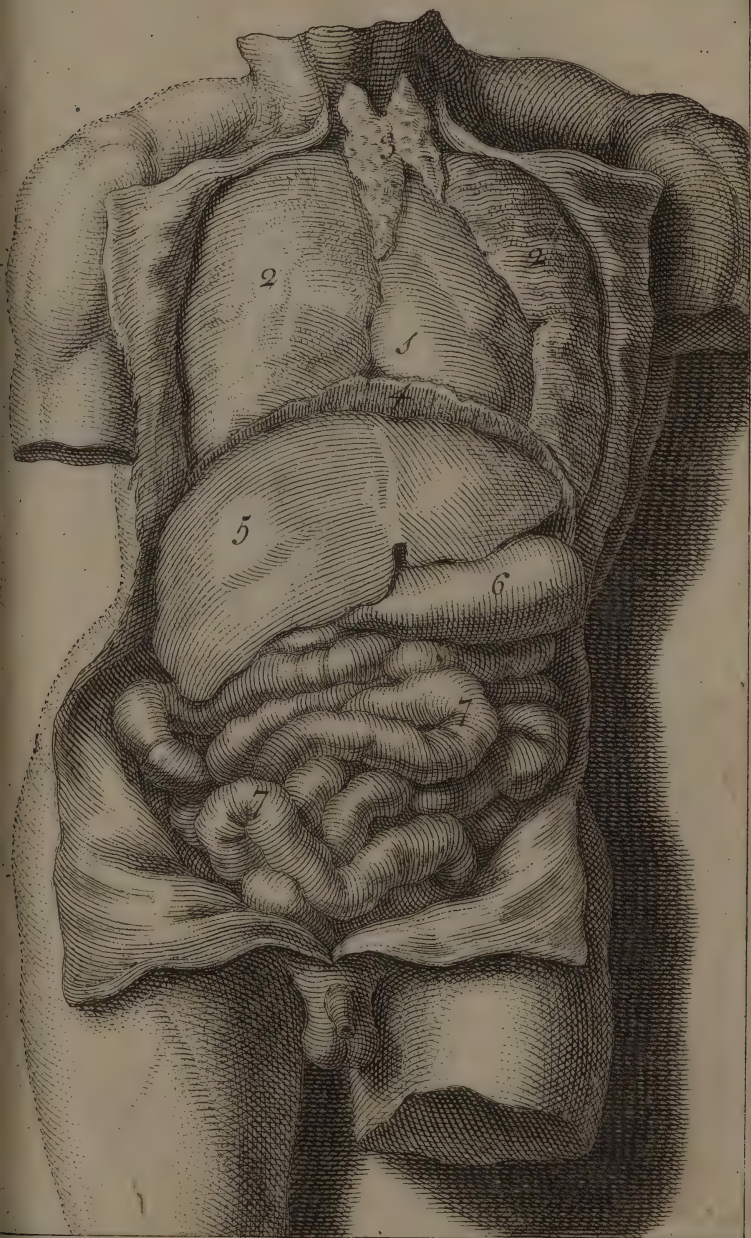
hension is very little, and whose parts are perhaps no finer than light, may move very freely in them. Those who deny animal spirits in the nerves, suppose that the sensation is conveyed by a vibration. To which it is objected, that they are slack, moist, and surrounded with soft parts, and are therefore unfit for vibrations, as indeed they are for such as are made on the strings of a musical instrument; but the minutest vibrations, such as they cannot be without, may be as sufficient for this end, as the impulse of light upon the Retina, is for the sense of seeing. So that for ought that I can discern, sensations may be conveyed either, or both ways, tho' the advocates for each opinion, have chiefly insisted upon the improbability or impossibility of the other opinion.

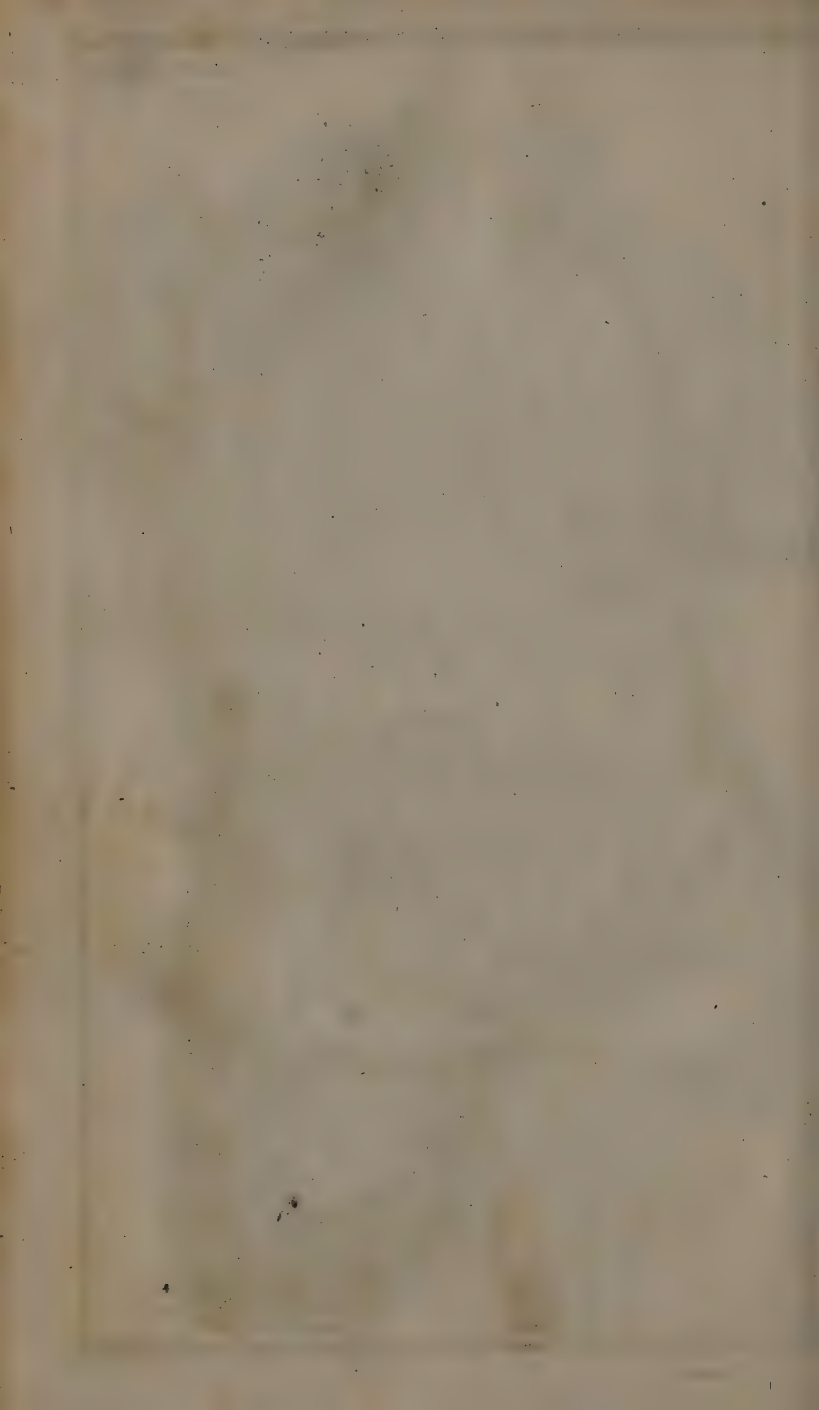


## T A B L E XIV.

1. The Pericardium covering the heart.
- 2, 2. The lungs.
3. The gland Thymus.
4. The diaphragm.
5. The liver.
6. The stomach.
- 7, 7. The small guts.

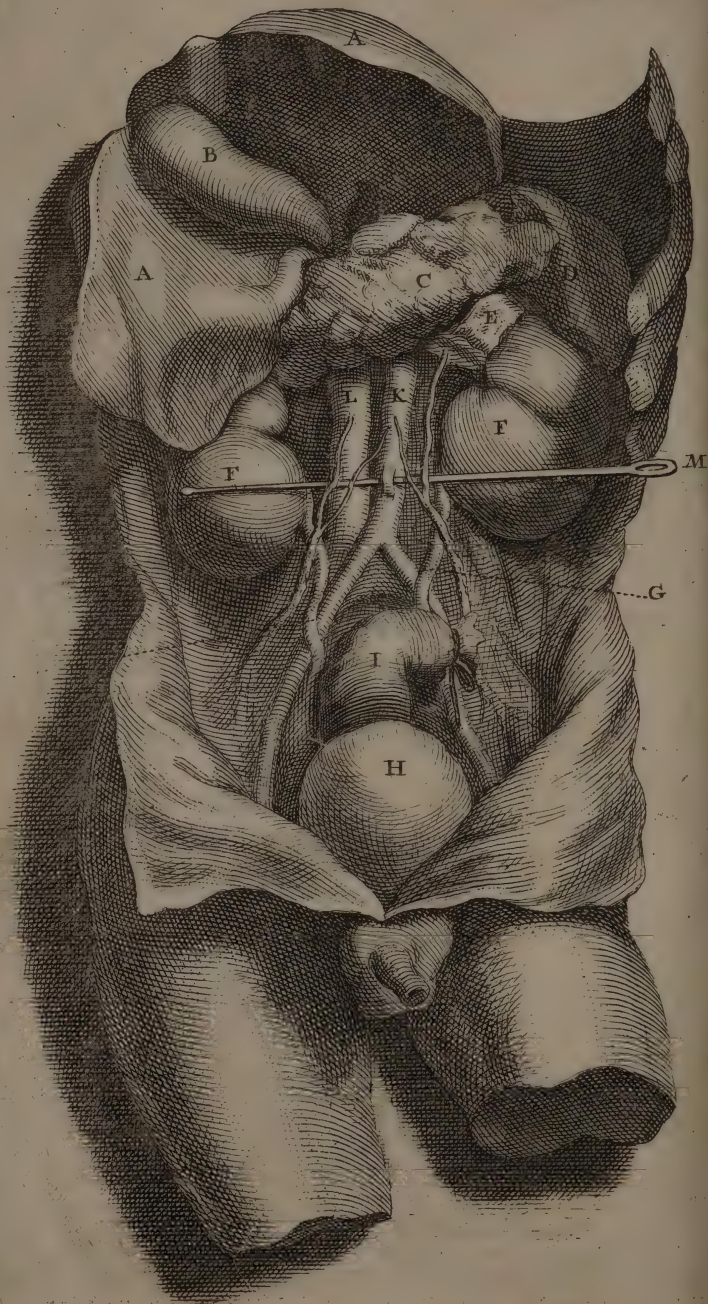












## T A B L E XV.

- A, THE liver.
- B, The gall-bladder.
- C, The Pancreas.
- D, The spleen.
- E, One of the renal glands.
- F, F, The kidneys.
- G, G, The ureters.
- H, The bladder of urine distended.
- I, The Rectum Intestinum.
- K, The Aorta.
- L, The Vena Cava.
- M, The four spermatick vessels, with the Arteria  
     Mesenterica Inferior, raised over a probe;  
     the middle one the Arteria Mesenterica  
     Inferior; the two next the spermatick ar-  
     teries arising from the Aorta; the outmost  
     the spermatick veins, the right ending in  
     the Cava, the left in the left emulgent  
     vein.

TABLE

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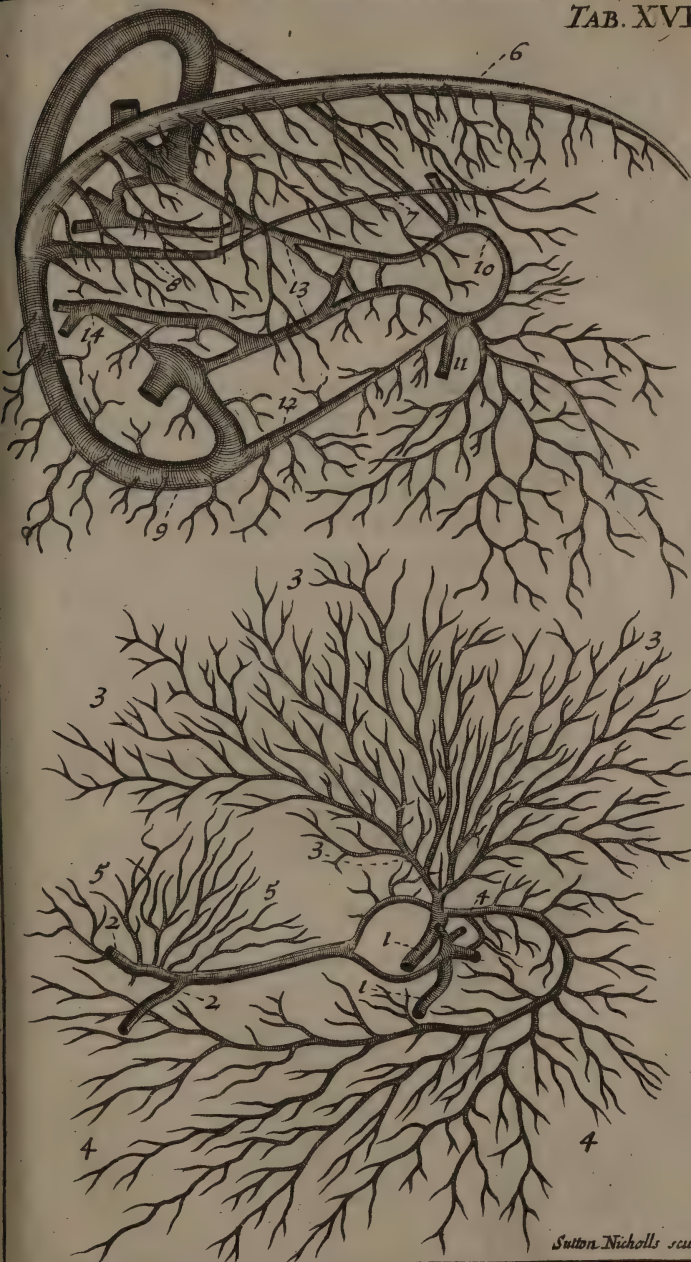
## T A B L E XVI.

*The vessels of the brain filled with wax.*

- 1, 1. The carotid artery.
- 2, 2. The cervical artery.
- 3, 3, &c. The branches of the carotid artery which passes between the lobes of the brain on the left side.
- 4, 4, 4. The branches from the carotid artery which pass between the hemispheres of the brain.
- 5, 5. The branches from the cervical artery, which are bestowed upon the Cerebellum.
6. The superior longitudinal Sinus.
7. The inferior longitudinal Sinus.
8. The strait Sinus.
9. The lateral Sinus.
10. The circular Sinus.
11. A vein from the circular Sinus.
12. A Sinus at the upper edge of the Os Petrosum.
13. A Sinus at the lower edge of the Os Petrosum.
14. The cervical Sinus.

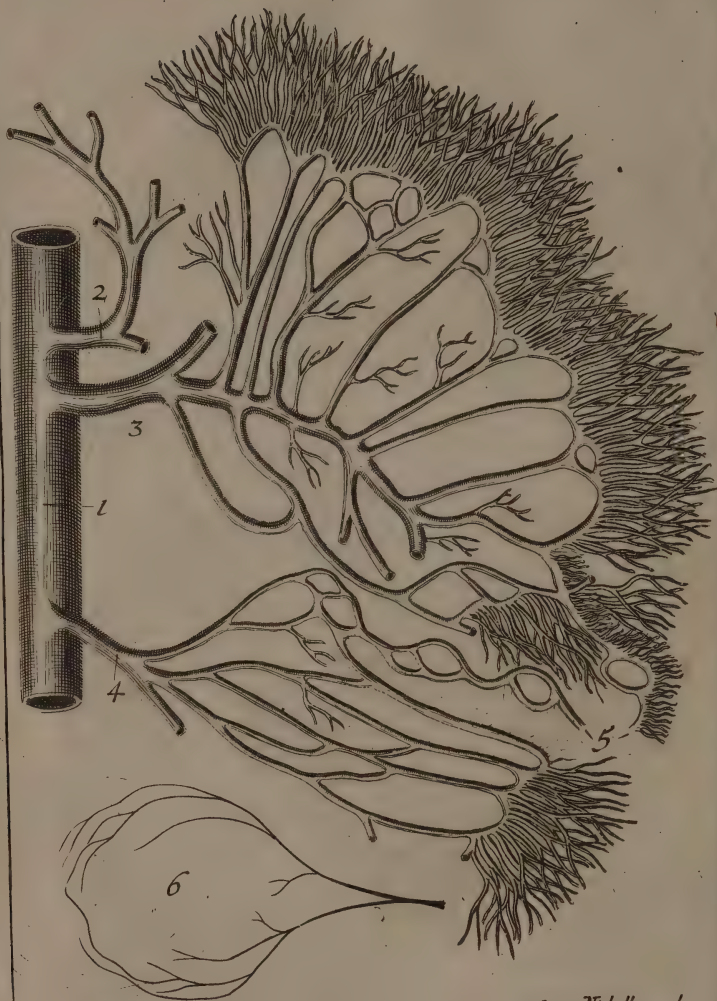
T A B L E.











Sutton Nicholls sculp.



## T A B L E XVII.

*Arteries filled with wax.*

1. Part of the descending Aorta.
2. Arteria Coeliaca.
3. Mesenterica Superior.
4. Mesenterica Inferior.
5. Part of the communicant artery.
6. Shews one of the extreme mesenteric arteries,  
as it is distributed round the intestine.



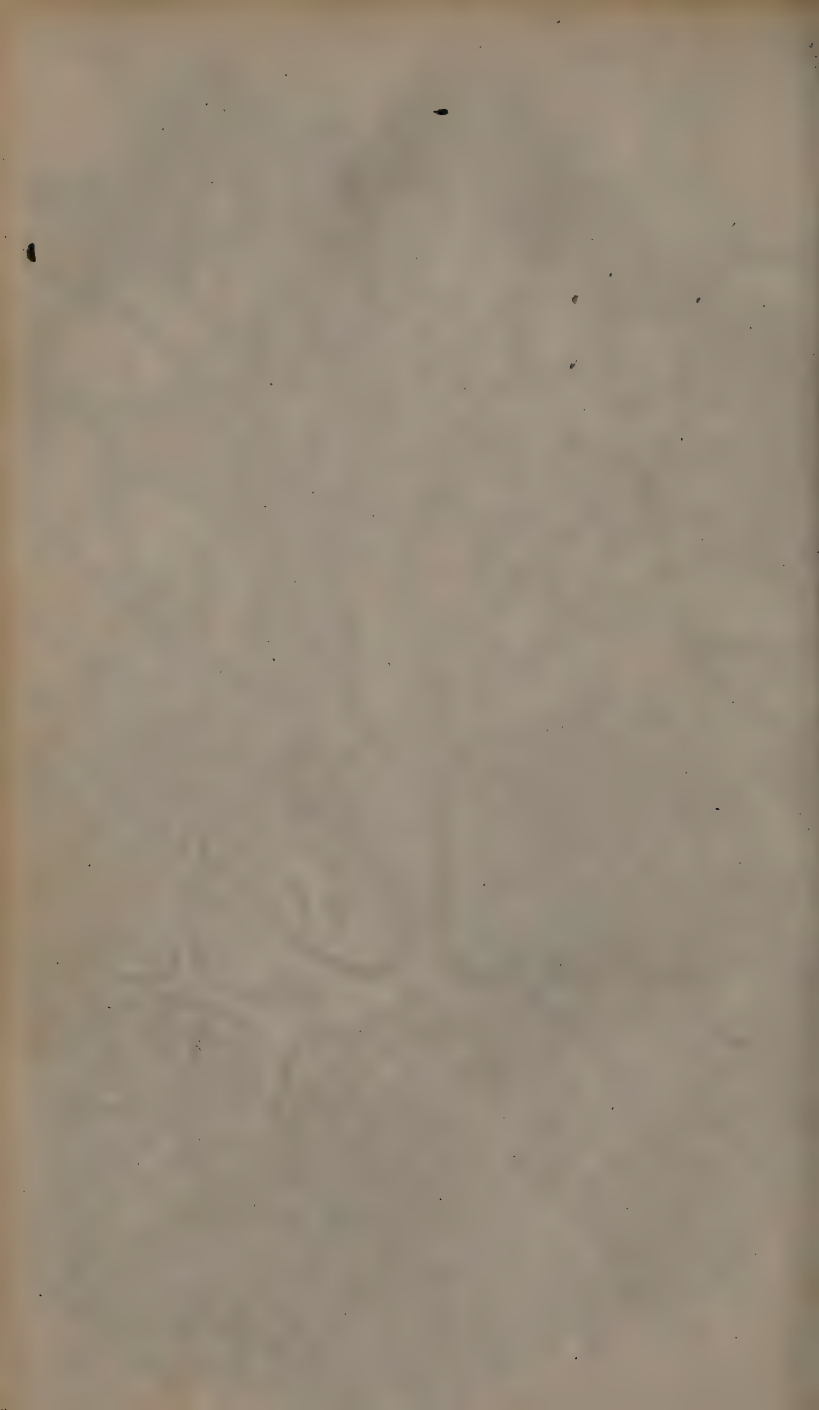
## TABLE XVIII.

*The Vena Portæ filled with wax.*

- 1, 1, 1. THE extreme branches of the Vena Portæ in the Mesentery.
2. The single trunk of the Vena Portæ entering the liver.
- 3, 3, 3. The extreme branches of the Vena Portæ in the liver.
4. One of the extreme mesenteric veins.



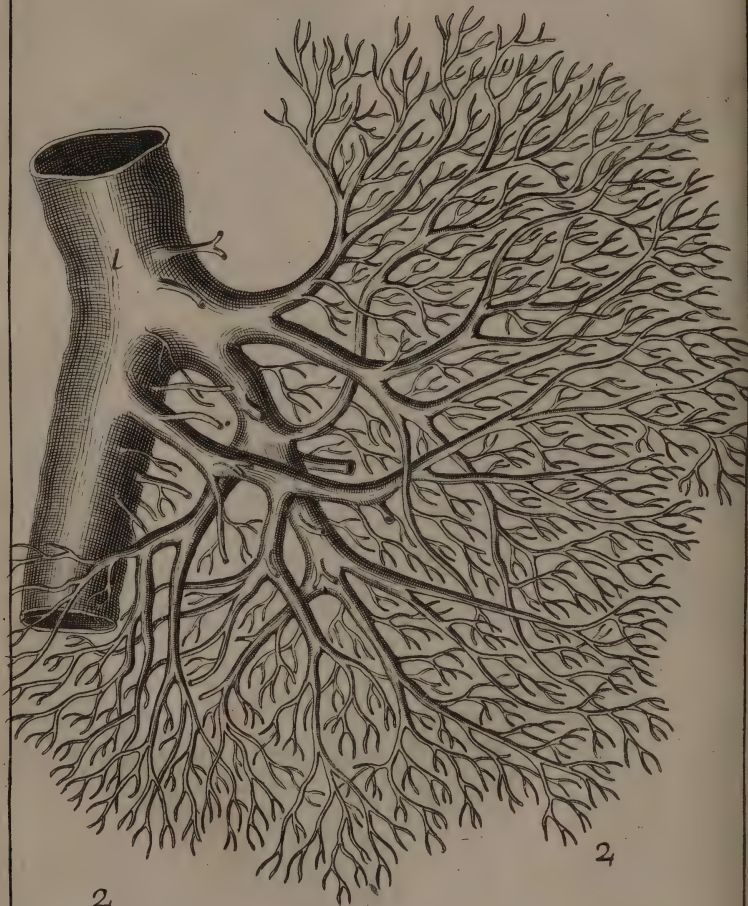








2



2

2

## T A B L E   X I X .

*The veins of the liver.*

1. PART of the Vena Cava Ascendens.
- 2, 2, 2. The branches of the Cava taken out of the liver.



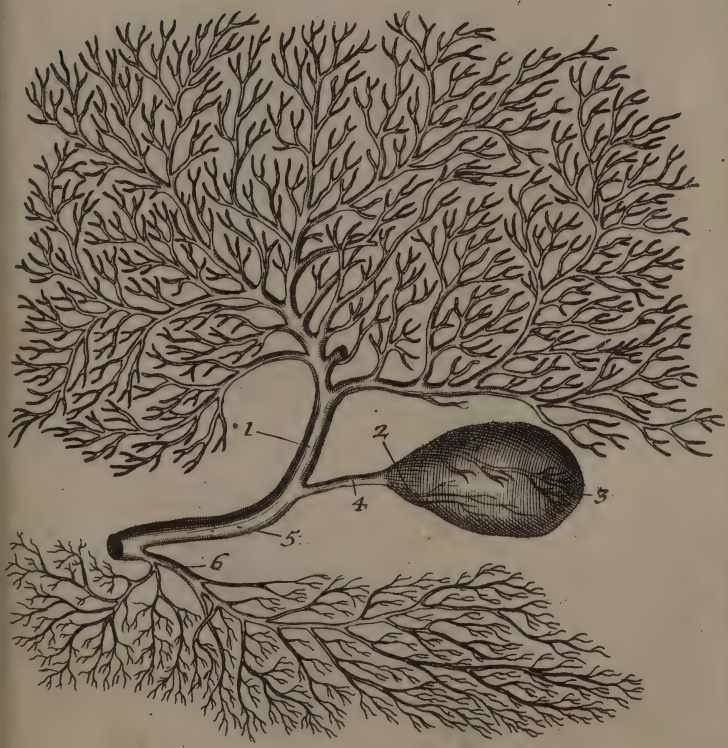
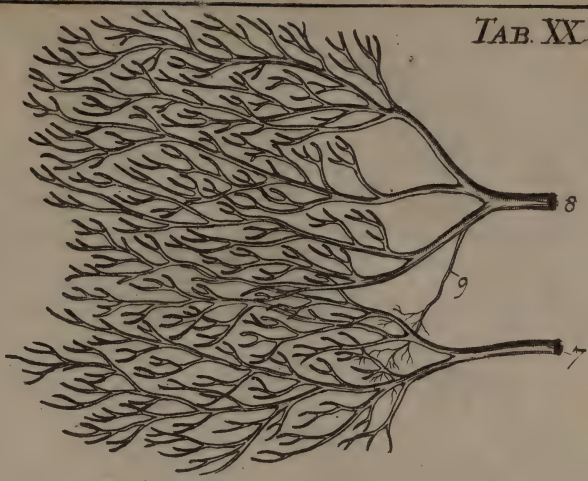
## TABLE XX.

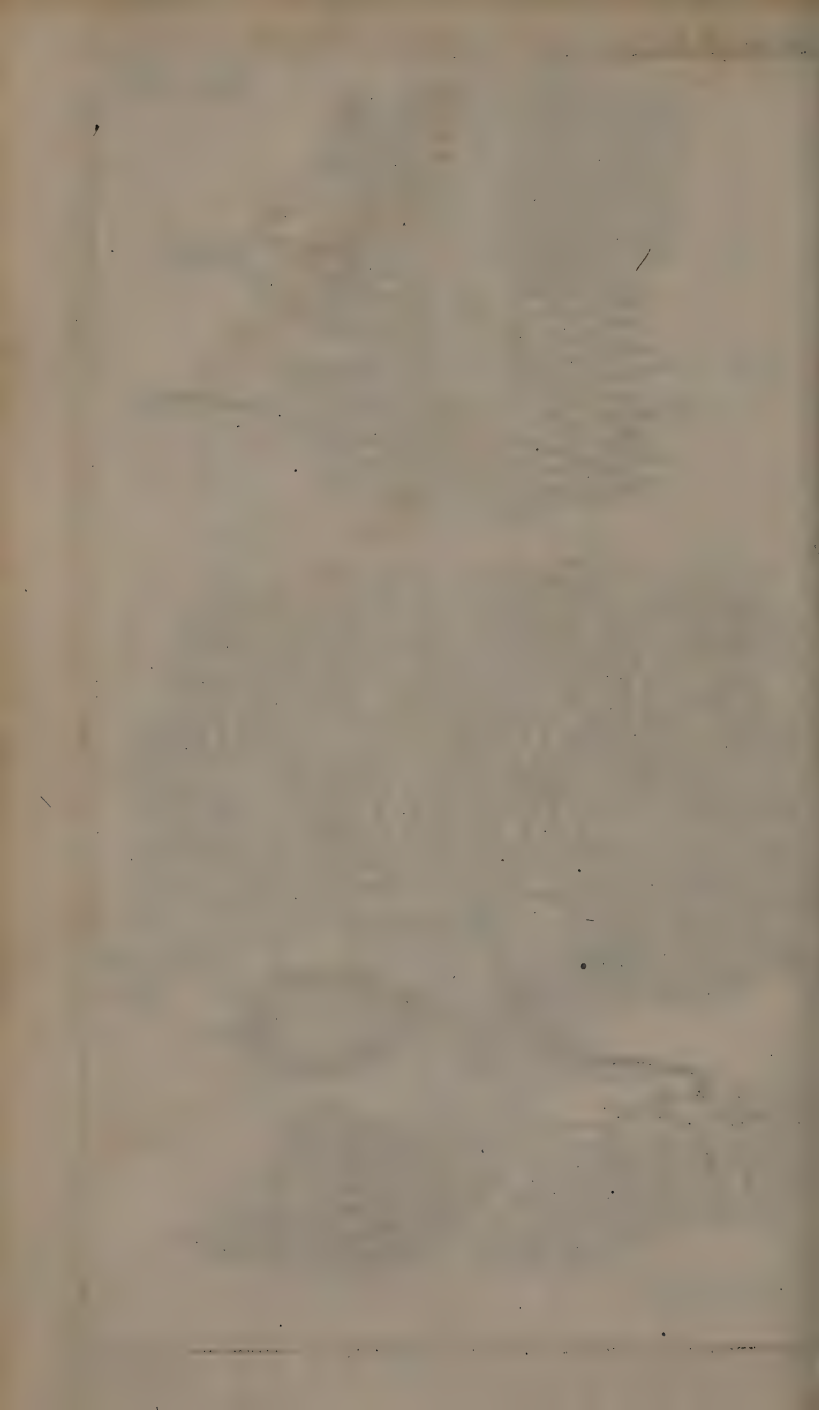
*The excretory ducts and arteries of the liver.*

1. DUCTUS HEPATICUS, with its branches, taken out of the liver.
3. The gall-bladder.
4. Ductus Cysticus.
5. Ductus Communis Choledochus.
6. Ductus Pancreaticus.
7. The hepatic artery, which is given off from the superior mesenteric.
8. The hepatic artery, which is given off from the celiac.
9. Arteria Cystica.

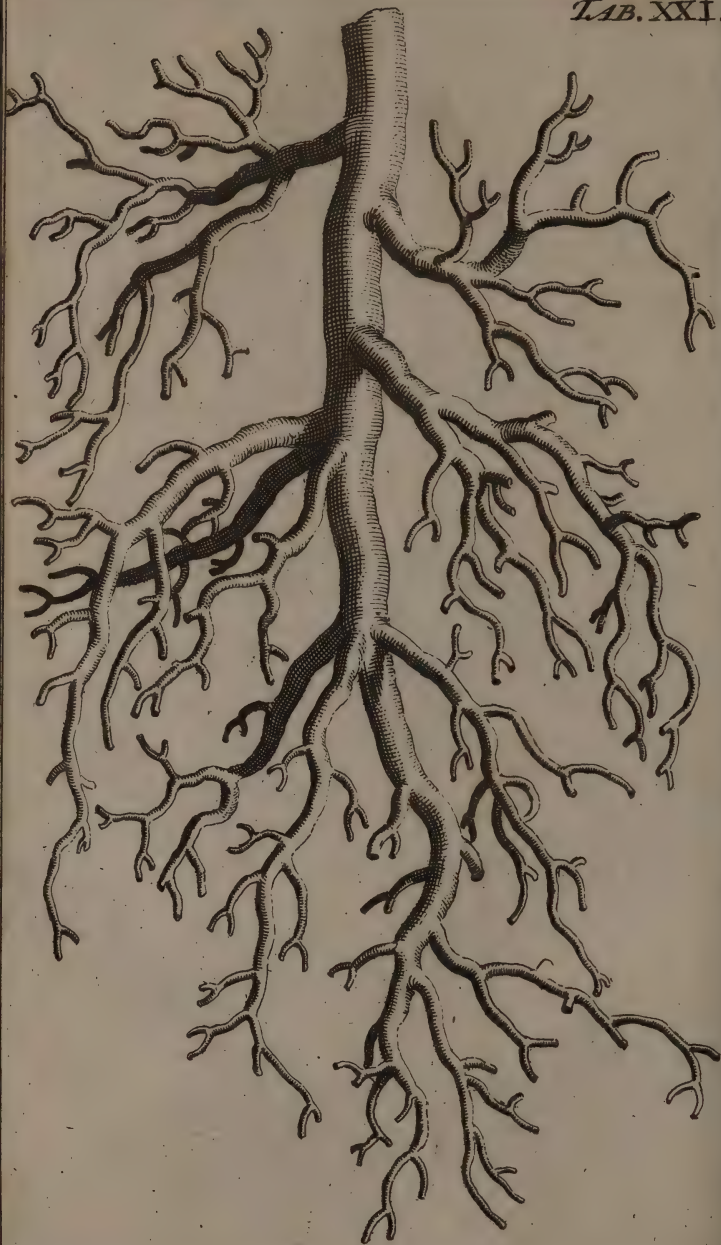














## T A B L E XXI.

A POLYPUS coughed up out of the lungs, which admirably shews the manner of the Aspera Arteria dividing in the lungs; communicated to me by the late Dr. Oliver Horseman.



## T A B L E XXII.

## FIGURE 1

SHEWS the circulation of the blood, in the tail of a greg, from Mr. Cowper.

A, A, A, Where the extremities of the arteries and veins communicate.

B, B, B, B, Several other communications.

## FIGURE 2

SHEWS the circulation of the blood, in the tail of a gudgeon.

A, A, A, The large vessels.

B, B, B, The extremities of arteries communicating with the veins.

C, C, Some small vessels whose extremities could not be seen for the thickness of the tail.



Fig. I.

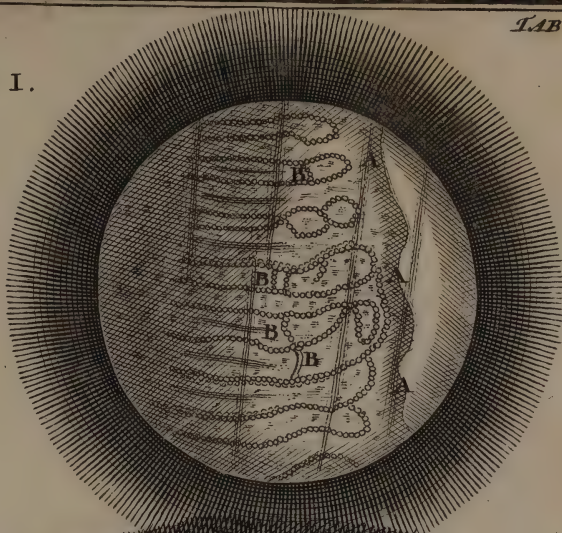
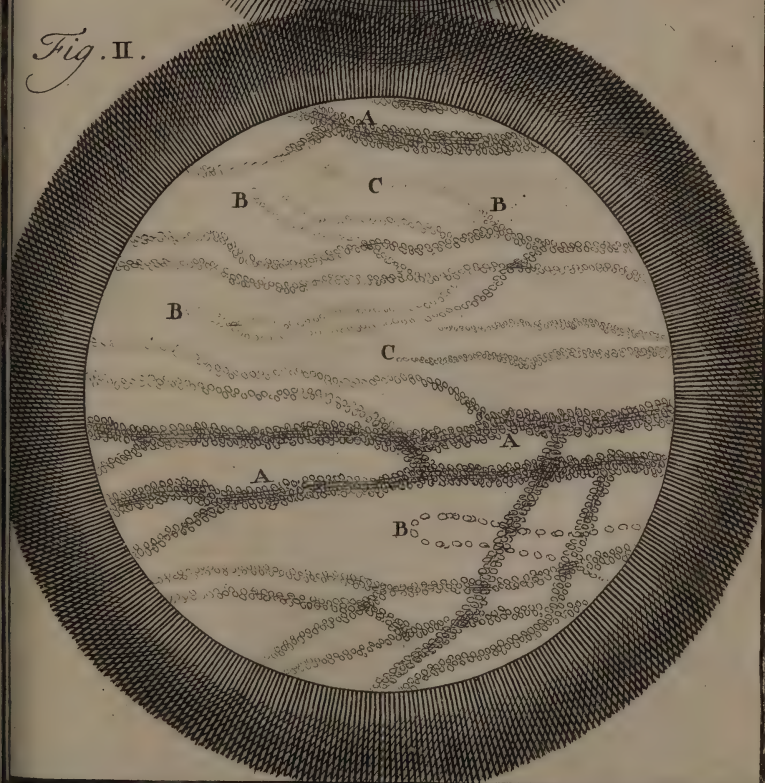


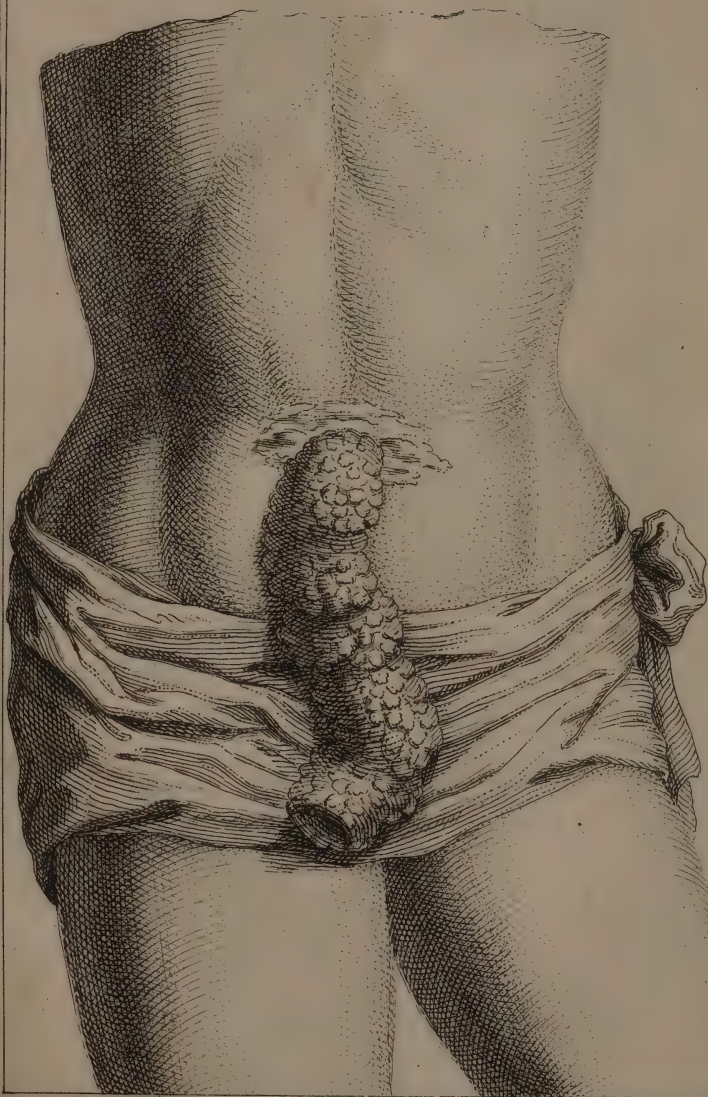
Fig. II.











## T A B L E XXIII.

THE case of Mrs. Stonestreet of Lewes, Vid.  
page 149.



## TABLE XXIV.

REPRESENTS the case of Margaret White,  
mentioned page 150.

A, The gut hanging out at the navel.

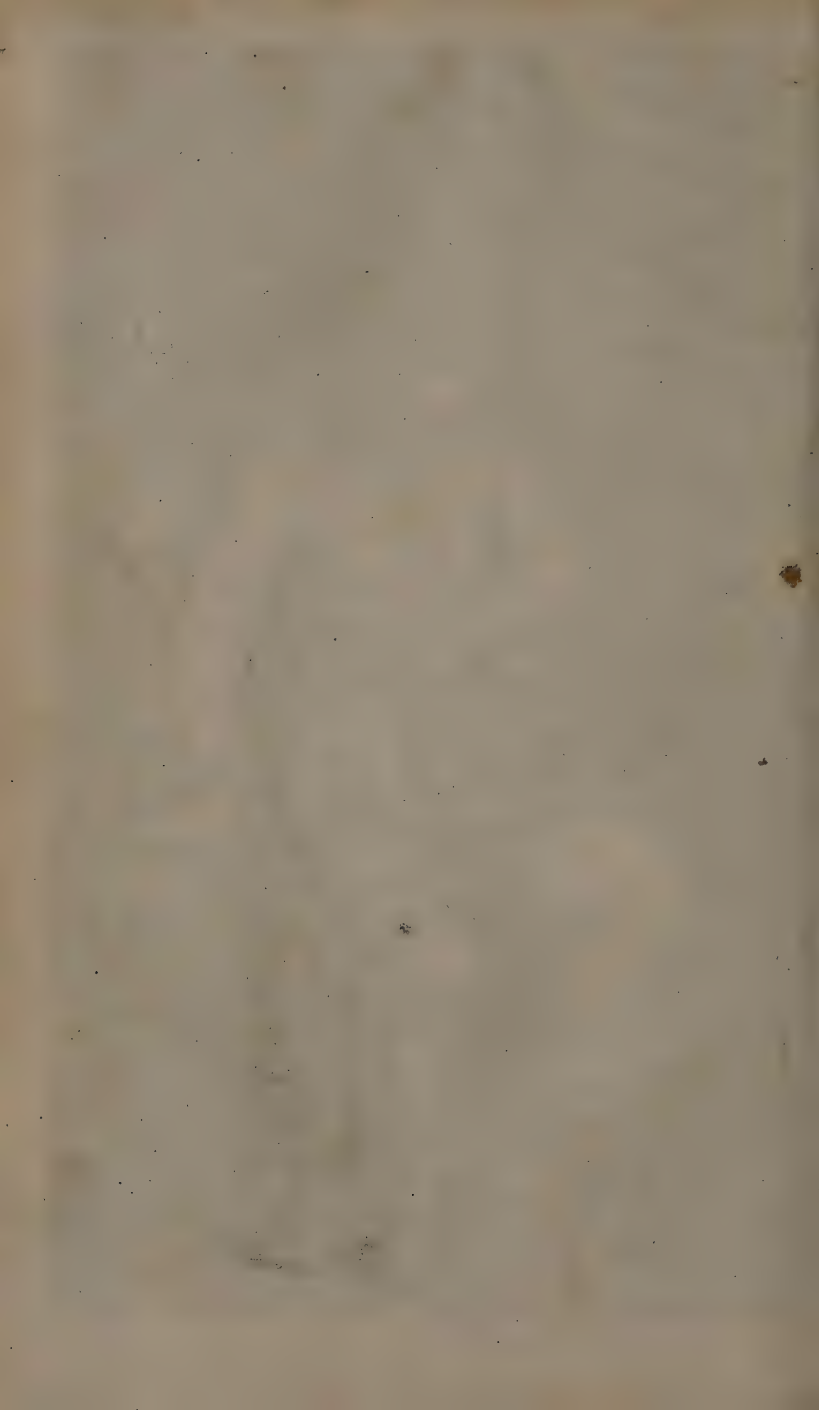


TABLE

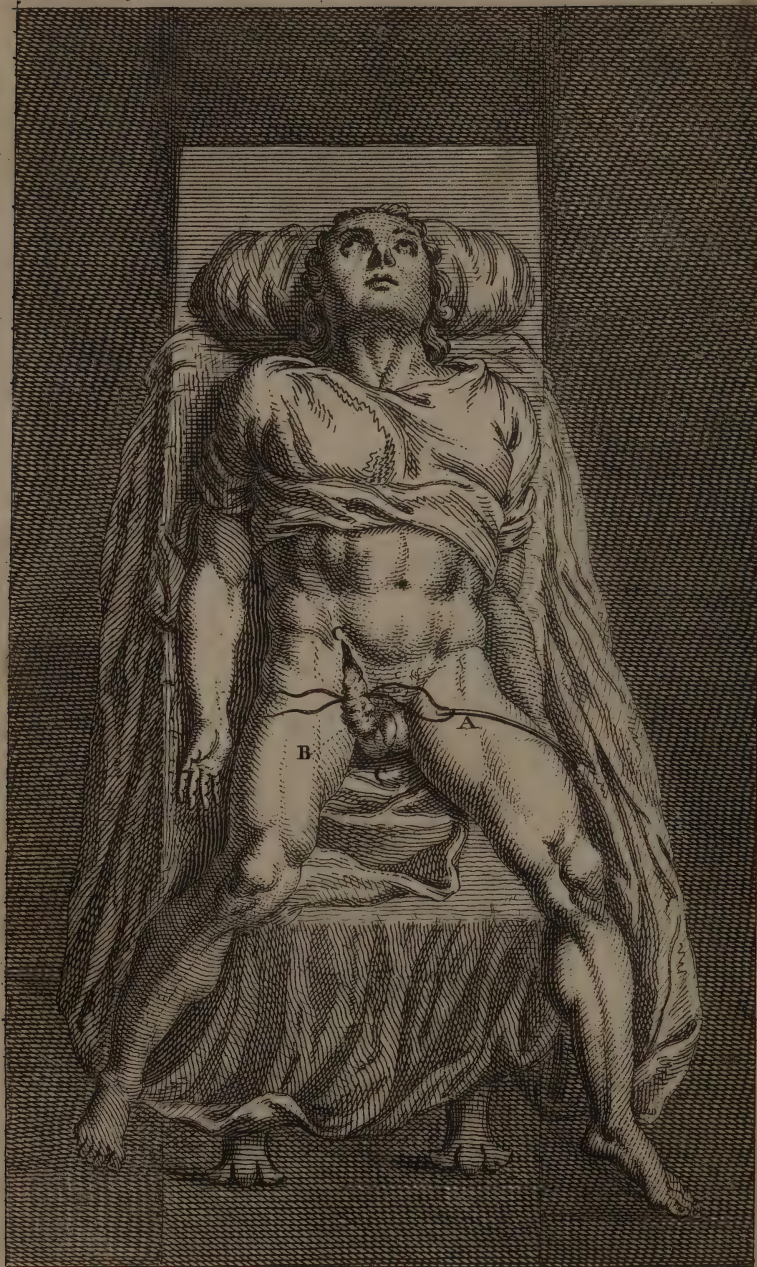












## TABLE XXV.

REPRESENTS the case of John Heysham; who, the friday before Easter in the year 1721, by over-straining himself at work, had a rupture of his intestines into his Scrotum, which could by no means be reduced. He was brought into St. Thomas's hospital the monday following, and I would have performed the operation immediately, but he refusing to submit, I deferred it till tuesday morning, when he being willing, I performed the operation, and making a large wound in the bottom of the Abdomen, the intestines were easily reduced, and near a quart of water was discharged out of the Scrotum at the same time. There had been a rupture of the Omentum before, and it being united to the Scrotum and spermatic vessels, I passed a needle, with a double ligature (as is expressed in the plate) under that part of the Omentum that adhered, so as not to hurt the spermatic vessels; then cutting out the needle, I tied one of the strings over the upper part of the Omentum, and the other over the lower, and then cut off as much of it as was in the way. My reason for tying in this manner was to secure the blood-vessels, which, I think, could not be done so well with one ligature, because of the largeness of the adhesion and the texture of the Omentum, which renders it too liable to be torn by such a bandage. Three days after the operation an Erisipylas begun in his legs, and spread all over his body, the cuticle every  
where

where peeling off; yet he recovered, and continues in a good state of health. After he was cured, at first he wore a small truss, but left it off in a short time, and feels no inconveniencies from it, though he lives by hard labour.

A, The needle threaded with a double ligature.

B, The Omentum.

C, C, The extremities of the wound.



TABLE







## T A B L E XXVII.

THE lower parts of a negroe, whose Scrotum was swelled to this size from a kick (the spermatic vessels being not at all thickened.) The greatest length was twenty seven inches, and the greatest horizontal circumference forty two inches. He was the late Mr. Dickenson's patient in St. Thomas's hospital; the tumor was solid, without inflammation or pain, but what parts were affected we could not learn, he not staying for the operation. At the dark place he could pull out his Penis, when the Scrotum was lifted up.







# BOOK IV.

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## CHAP. I.

*Of the urinary and genital parts of men,  
together with the Glandulæ Renales.*

**T**HE urinary parts are the kidneys with their vessels and bladder of urine.

THE kidneys of men are like those of a hog, the two weigh about twelve ounces; they are seated towards the upper part of the loins upon the two last ribs, the right under the liver, and a little lower than the other, and the left under the spleen. Their use is to separate the urine from the blood, which is brought thither for that purpose by the emulgent arteries; and what remains from the secretion, is returned by the emulgent veins, while the urine secreted is carried off through the ureters to the bladder. Tab. xv. F.  
Tab.  
xxvii. 5.

THE ureters, are tubes about the bigness of goose-quills; and about a foot long, they arise from the hollow side of the kidneys, and end in the bladder near its neck, running obliquely for the Tab. xv.  
G, G.  
Tab.  
xxvii. 8.



Tab. xxvii. 22. the space of an inch between its coats; which manner of entering, is to them as valves. (Vide page 167.) The beginning of the ureters in the kidneys, are the Tubuli Urinarii, which join from the Pelvis in each kidney. Between the Tubuli Urinarii, authors have remarked small Papillæ; and the parts which distinguish themselves by a clearer colour, they call Glandulæ.

Tab. xxvii. 11. Tab. xxvii. 10.

Tab. xv. H. THE bladder of urine, is seated in a duplicature of the Peritoneum in the lower part of the Pelvis in the Abdomen; its shape is orbicular, and its coats are the same with those of the guts, and other hollow muscles already described, viz. an external membranous, a middle muscular, which is the Musculus Detrusor Urinæ, and an inner membranous coat, exceeding sensible, as is fully shewn in the cases of the stone and gravel. The use of this nice sense is, to make it capable of that uneasiness which excites animals to exclude their water, when the bladder is much extended. Some anatomists, not thinking how soon fluids taken into the stomach, and not retained there, by being mixed with solids, may pass into the blood, as the effects from drinking strong liquors, or Laudanum, or drinking without eating when we are hot, sufficiently shew; and also not considering the shortness of the course, from the stomach to the kidneys this way, together with the size of the emulgent arteries, and the velocity of the blood in them, have imagined and affirmed, that there must be some more immediate course from the stomach or guts to the bladder; and not considering either how such a course

course would have interrupted one great end in the animal œconomy, or that vessels fit to fill the bladder faster than the ureters, must have been too large to be concealed.

GLANDULÆ RENALES, are two glands Tab. xv. E. Tab. xxvii. 7. seated immediately above the kidneys, of no certain figure, nor do we know their use; but always paint and describe them with the urinary parts because of their situation: In a very young Fœtus they are larger than the kidneys, and in an adult but a little larger than in a Fœtus. They receive a great many small arteries, and return each of them one or two veins. In their inside is a small Sinus tinged with a footy coloured liquor.

VALSALVA, in a discourse before the academy of sciences at Bologna, has given an account of a duct from these glands to the Epididymides in men, and the Ovaria in women, and undertook to prove that they are principal organs of generation, and promised to publish a treatise on this subject as soon as the cuts for it could be made; but being since dead, we do not yet know what was done towards it. Mr. Renby has searched very carefully to discover them, but in vain: However he has observed a small artery, which dividing, sends one branch into the renal gland, and the other into the Epididymis, which he thinks Valsalva has mistaken for a duct.

THE genital parts of men are the Testes and Penis, with their vessels, &c.

THE office of the Testes, is to separate the seed from the blood; they are seated in the Scrotum, and

and are said to have four coats, two common, and two proper. The common are the outer skin and a loose membrane immediately underneath, called Dartos. The first of the proper, is the Proceſſus Vaginalis; it is continued from the Peritoneum to the teſticle, which it incloſes with all its veſſels, but is divided by a Septum, or an adheſion immediately above the teſticle, ſo that no liquor can paſs out of that part of this membrane which encloſes the ſpermatic veſſels into that which encloſes the teſticle. Large quantities of water are ſometimes found in theſe cavities, which diſeaſe is ſeldom cured without opening the cavity where the water is contained, as in ſinuous ulcers: But a true Hernia Aquoſa is a rupture through the Peritoneum from the Abdomen, which may be cured by a puncture; and in this caſe, as in the Hernia Inteſtinalis, and Omentalis, when once a cavity is ſtretched out, the inside of it is ſoon formed into a ſtrong membrane like that of a Cyſtic tumour, and looks as if the Peritoneum it ſelf had been ſtretched down thither, and thickened. (Vid. Muſculi Abdominis.) The other proper coat, is the Albuginea, which is very ſtrong, immediately incloſing the teſticles. The teſticles of a rat may be unraveled into diſtinct veſſels, and the texture of the teſticles of all other animals appear to be the ſame, but their veſſels are too tender, or cohere too much to be ſo ſeparated.

Tab.  
xxviii.  
A, B, D.

Tab. xv.  
M.  
Tab.  
xvii. 12.

THE teſticles, receive each, one artery from the Aorta, a little below the emulgent, which, unlike all other arteries, ariſe ſmall, and dilate

in their progress, that the velocity of the blood may be sufficiently abated for the secretion of so viscid a fluid as the seed. The right testicle returns its vein into the Cava, and the left into the emulgent vein on the same side; both because it is the readiest course, and because, as authors say, this spermatic vein would have been obstructed by the pulse of the Aorta, if it had crossed that vessel to go to the Cava. Tab. xxvii. 13.

A GENTLEMAN whom I castrated, who trusted too much to his own resolution, and refusing to have any one present to hold him, except Mr. Geeke, who was my assistant; during the operation, moved so much, that the ligature which tied all the vessels with the process together, slipped, and only tied the process over the ends of the vessels; which being perceived soon after the operation, I cut the ligature, and took out the extravasated blood, and tied the artery alone, which gave but little pain, and it digested off in a week's time; and the wound being afterwards stitched, though the testicle weighed a pound, it was perfectly well in five weeks; which is in less time than the ligature often requires to be digested off, when the process and all the vessels are tied together. However if this case is not sufficient to recommend doing this operation by tying the artery only, it may be sufficient to recommend extraordinary care in doing of it the usual way, for if the blood had found an easy passage into the Abdomen, the patient might have bled to death without our knowledge.



Tab.  
xxvii. 17.

ON the upper part of the testicles, are hard bodies called Epididymi; which are evidently the beginnings of the Vasa Deferentia. I have unravelled them backward, in single vessels, and then into more and smaller, like the excretory vessels of other glands.

Tab.  
xxvii. 18.

VASA DEFERENTIA, are excretory ducts to carry the elaborated seed to the Vesiculæ Seminales. They pass from the Epididymi of the testicles, together with the blood-vessels, till they have entered the muscles of the Abdomen, and then they pass under the Peritoneum, directly through the Pelvis, to the Vesiculæ Seminales.

Tab.  
xxvii. 19.

VESICULÆ SEMINALES, are two bodies that appear like vesicles; they are seated under the bladder of urine, near its neck; they may be each of them easily unravelled into one single duct, which discharge into the Urethra, by the sides of the Rostrum Gallinaginis, which is an eminence in the under side of the Urethra, near

Tab.  
xxvii. 21.

the neck of the bladder. In these vesicles or ducts the seed is repositied against the time of coition; but in dogs there are no such vesicles, therefore nature has contrived a large bulb in their Penis, which keeps them coupled, seemingly against their inclinations, till the seed can arrive from the testicles. The seed passes from these vesicles in men, and even from the Vasa Deferentia, in time of coition, through the prostrate glands into the Urethra, as in those animals that have no Vesiculæ Seminales; for when the ducts into the Urethra are distended, that is the direct-  
est



est course from the Vasa Deferentia, as well as from the Vesiculæ Seminales.

PROSTATÆ, are two glands, or rather one, Tab. about the size of a nutmeg: They are seated between the Vesiculæ Seminales and Penis, under the Offa Pubis, almost within the Pelvis of the Abdomen. They separate a lymphid glutinous humour, which is carried into the Urethra by several ducts, which enter near those of the Prostatæ; this liquor seems to be designed to be mixed with the seed in the Urethra, in the time of coition, to make it flow more easily.

PENIS, its shape, situation and use, need no description. It begins with two bodies, named Crura, from the Offa Ischia, which unite under the Offa Pubis, and are there strongly connected by a ligament. In its under part is a channel from the bladder, called Urethra, through which both the urine and seed pass; its fore-part is called Glans, the loose skin which covers it, Præputium, and the strait part of that skin on the under side, Frœnum.

THE Urethra, is lined with a membrane filled with small glands, that separate a Mucus, that defends it from the acrimony of the urine. These glands are largest nearest the bladder. Mr. Cowper describes three large glands of the Urethra, which he discovered; two of which are seated on the sides of the Urethra, near the ends of the Crura Penis; to which he adds a third, less than the other, seated almost in the Urethra, a little nearer the Glans than the former. All these glands have excretory ducts into the Urethra.

Tab.  
xxvii.  
A, A.

THE inner texture of the Penis is spongy, like the inner texture of the spleen, or the ends of the great bones. It is usually distinguished into Corpus Cavernosum Penis, Glandis and Urethræ; the first of these makes part of the Glans, and is divided its whole length by a Septum; the other two are composed of smaller cells, and are but one body. On the upper side of the Penis, are two arteries, and one vein called Vena Ipsius Penis. The arteries are derived from the beginnings of the umbilical arteries, which parts never dry up, and the vein runs back to the iliac veins. The Vena Ipsius Penis, being obstructed, the blood that comes by the arteries, distends the cells of the whole Penis, and makes it erect; but to prevent any mischief from this mechanism, there are small collateral veins on the surface of the Penis, that carry back some blood all the time the Penis is erect. By what power the Vena Ipsius Penis is obstructed to erect the Penis, I cannot conceive, unless small muscular fibres constrict it. Most authors think the Musculi Erectores Penis do it, by thrusting the Penis against the Os Pubis; but they are not seated, as Mr. Cowper observes, conveniently for such an office; besides, if a pressure from the lower side of the Penis is sufficient, an artificial pressure, which may be much greater, should, I think, produce the same effect. When the matter of a gonorrhea is so virulent as to make ulcers in the Urethra, when those ulcers cicatrise they constrict the Urethra, and make that difficulty in the waters passing, which is vulgarly thought to proceed from caruncles.

IN the seed of men, and of many other male animals, Lewenhoeck, by the help of microscopes, discovered an infinite number of animals like tadpoles, which he and others suppose to be men in miniature, and that one of these being entered into an egg in one of the Ovaria, (See the next chapter.) conception is performed. But though scarce any one, that has made due enquiry, has ever doubted of the existence of these animals, yet there are many who object against this hypothesis; and though I am inclined to think it true, yet I will endeavour impartially, to lay down the principal objections and answers, that the reader may judge for himself. The first and strongest objection, is raised from the several instances that have happened of mixed generation, where the animal produced always appears to partake of both kinds, as in the common case of a mule, which is begot by an ass upon a mare; when according to that hypothesis, they expect the animal produced from mixed generation, should be entirely of the same species with the male animal; as the seeds of plants, whatever earth they grow in, always produce plants of the same kind; nevertheless if we consider what influence womens fears or longings, frequently have upon their children in Utero, and how great a change castration makes in the shape of any animal, and that a lamb suckled by a goat (if I have been rightly informed) grows hairy like a goat, we cannot then wonder if the mothers blood, to which the animal owes its nourishment and increase, from the time of impregnation to the time of its birth, should be thought a sufficient cause

Tab.  
xxviii. E.

of resemblance between these animals and their mothers. Another objection is, that nature should provide such a multiplicity of these animals, when so few can ever be of use, an animal being to be generated of one only. To which it has been answered, that in all plants a vast number of seeds are found, though a very few of the whole that are produced, fall into the earth, and produce plants; and as in plants the greatest part of their seeds are the food of animals, so the greatest part of the *Animalculæ*, may as well live a time to enjoy their own existence, as any other animal of as low an order. The last objection is their shape, which I think, will appear to have no weight, when we consider how the eggs of flies produce maggots, which grow up into flies; and the tadpole produced from the egg of a frog, grows into a form as different from a tadpole as the form of a man: And if these animals had produced so few at a time, as that their young might have undergone this change in Utero, it is highly probable, that we should not so much as have suspected these analogous changes. But how the *Animalculæ* themselves are produced, is a difficult question, unless by equivocal generation, seeing none of them appear to be in a state of encrease, but all of a size.

IN a boy that died of the stone, I found a double Ureter, each part being dilated to an inch diameter; the Pelvis in each kidney to twice its natural bigness, and the *Tubuli Urinarii*, each as large as the Pelvis.



IN a man that had never been cut for the stone, I found the Ureters dilated in some places to four inches circumference, and in others but little dilated, and a stone that I found in the bladder was less than a nutmeg, which must have fallen in several pieces, or both ureters could not have been dilated. From this, and other like observations, I think it appears that the prodigious size to which the ureters are usually extended, in people who are troubled with the stone, is owing to small stones which stick at the entrance into the bladder, until the obstructed urine which dilates the ureters, can force them into the bladder.

I HAVE once met with a kidney almost consumed, and lymphatics in a diseased testicle, as large as a crow-quil.

## CH A P. II.

### *Of the genital parts of women.*

THE external parts, are the Mons Veneris, which is that rising of fat covered with hair above the Rima Magna upon the Os Pubis, the great doubling of the skin on each side the Rima called Labia, and within these a lesser double named Nymphæ. These help to close up the orifice<sup>1.</sup> of the Vagina: The Nymphæ are usually said<sup>Tab.xxix.</sup> to serve to defend the Labia from the urine;<sup>2.</sup> but I do not see how the Labia stand more in



need of such a defence, than the Nymphæ themselves.

CLITORIS, is a small spongy body bearing some analogy to the Penis in men, but has no Urethra. It begins with two Crura from the Offa Ischia, which uniting under the Offa Pubis, it proceeds to the upper part of the Nymphæ, where it ends under a small doubling of skin, called

Tab.xxix.

3.  
Tab.xxix

4.

Preputium; and the end which is thus covered is called Glans. This is said to be the chief seat of pleasure in coition in women, as the Glans is in men.

A LITTLE lower than this, just within the Vagina, is the exit of the Meatus Urinarius.

Tab.xxix.

6.

VAGINA, is seated between the bladder of urine and the Intestinum Rectum. The texture of it is membranous, and its orifice is contracted with a Sphincter (Vid. Musc. Sphincter Vaginæ;) but the farther part is capacious enough to contain the Penis without dilating. Near the beginning of the Vagina, immediately behind the orifice of the Meatus Urinarius, is constantly found in children, a valve called Hymen, which looking towards the orifice of the Vagina, closes it in the same manner that the valves of the ventricles of the heart, close the entrance of the ventricles; but as children grow up, and the Sphincter Vaginæ grows more useful, this valve is proportionably smaller, and in women very rarely to be found, only some small parts appearing in the place of this valve called Carunculæ Myrtiformes. There have been a few instances in which the edges of this growing together, it continued unperforate

perforate, until it has been necessary to make an incision to let out the *Menses*. The inner part of the *Vagina* is formed into *Rugæ*, which are largest in those who have not used copulation; and least in those who have had many children. Under these *Rugæ* are small glands, whose excretory ducts are called *Lacunæ*: These glands separate a mucilaginous matter to lubricate the *Vagina*, especially in coition; and are the seat of a *Gonorrhea* in this sex, as the glands in the *Urethra* are in the male.

**UTERUS**, is seated at the end of the *Vagina*; Tab.xxix.  
8. it is about one inch thick, two broad, and large enough to contain the kernel of a hazel nut; but in women that have had children a little larger. Its orifice into the *Vagina*, is called *Os Tin-* Tab.xxix.  
*cæ*, from the resemblance it bears to a tennon's 7. mouth. It has two round ligaments which go Tab.xxix.  
12. from the sides of it to the groins through the oblique and transverse muscles of the *Abdomen*, in the same manner as to the seminal vessels in men. This way the gut passes in a *Hernia Intestinalis* in women, (*Vid. Musculi Abdominis.*) Some authors mention *Ligamenta Lata*, which are nothing but a part of the *Peritoneum*. Near the sides of the *Uterus* lie two bodies called *Ovaria*, they are Tab.xxix.  
of a depressed oval figure about the size of men's 11. testicles, and have spermatic vessels; they contain small pellucid eggs, from which they have their name. There are two arteries and two veins which pass to and from the ovaries or testes, in the same manner that they do in men; but make more windings, and the arteries dilate more suddenly,

denly, in proportion as they are shorter. These arteries and veins detach branches into the Uterus and Fallopian tubes, and not only make communication betwixt the artery and vein on one side and those of the other, but also with the proper vessels of the Uterus detached from the internal iliac arteries and veins. From these vessels both arteries and veins in the inside of the Uterus, the menstrual purgations are made in women, and something of the same kind in brutes, as often as they desire coition. One use of these purgations is, to open the vessels of the Uterus, for the vessels of the Placenta to join to them. Many authors have imagined that there must be some evacuations analagous to this, in men, which I cannot see the necessity of; but on the contrary, I believe that men's not having such evacuations, is the true reason why their bodies grow larger and stronger than womens; and their continuing to grow longer before they are fit for marriage, I also take to be the true reason why there are more males born than females, in about the proportion of thirteen to twelve; for women being sooner fit for marriage than men, fewer will die before that time, than of men.

Tab.xxix. NEAR the sides of the Ovaria, are seated the

9. Tubæ Fallopianæ, one end of which is connected to the Uterus, and the side to the Ovarium

Tab.xxix. by a membrane, the other end being jagged, is  
10. called Morsus Diaboli. Among these jaggs is a

small orifice which leads into the tube, which near this end is about a quarter of an inch diameter, and thence growing gradually smaller  
passes

passes to the Uterus, and enters there with an orifice about the size of a hog's bristle. The use of these tubes is to convey the male seed from the Uterus to the Ovaria, to impregnate the eggs for conceptions; yet they are seemingly so ill adapted to this end, that many writers have supposed there must be some other passage from the Uterus to the Ovaria; but if we consider the case of conceptions found in these tubes, and the exact analogy between these and the tube of a hen, where we have the most undeniable proofs of the seed going through the tube, and of the eggs being impregnated that way, and of the eggs coming from the Ovarium through the tube, and seemingly with much greater difficulty than in women; and besides how frequently a matter like the male seed, (which I suppose is seed,) is found in the fallopian tubes of women, as I have found in executed bodies, and in a common whore that died suddenly, it appears almost certain, that the seed goes through the fallopian tubes to the Ovaria to impregnate eggs, which come back thro' the same tubes to the Uterus. I have seen in a woman both the Fallopian tubes unperforated, which upon the foregoing hypothesis, must have caused barrenness, and seed lodged in these tubes may have the same effect; which I take to be often the case of common whores, and women that use coition too frequently; and perhaps the fat in the membrane that connects the Ovaria to the tubes, may in very fat women, so keep these tubes from the Ovaria as to interrupt impregnations; and besides these cases, too much or too little of  
the



the Menfes, may deftroy or interrupt conceptions; but the latter cafe, efpecially in young women is very rare. From fuch caufes as thefe, and not from imbecility, I imagine it is that barrennefs oftener proceeds from women than men; and though women do not propagate to fo great an age as men, it is not, I believe, for want of being impregnated, but from their Menfes ceafing, and thofe veffels being closed which fhould nourish the Fœtus after the impregnation, as if on purpofe to prevent the propagation of a feeble and infirm fpecies. And from this confideration one cannot but think that the perfection of the Fœtus, notwithstanding it is firft formed in the male feed, depends more upon the female than the male, or elfe that nature would, for the fake of the fpecies, have been careful to hinder men as well as women from propagating in a declining age.

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## C H A P. III.

*Of the Fœtus in Utero.*

THE Fœtus in Utero is involved in two coats, viz. Chorion, which is external, and Amnion which immediately inclofes the Fœtus. They contain a quantity of liquor, which is a proper medium for fo tender a being as the Fœtus to reft in, and partly fecures it from external injuries, as the aqueous humour does the cryftalline in the eye; and when the membranes burft at the time of production, this humour lubricates the Vagina Uteri, to render the birth lefs difficult.



cult. And seeing the stomach of a Fœtus in Utero is always full of a fluid like what is contained in the Amnion, and the guts always filled with excrements; is it not reasonable to suppose that this fluid is frequently, during the time of gestation, swallowed by the Fœtus, if not for nourishment, at least to keep these parts in use, and to flow through the lacteals (as a quantity of blood from the right ventricle of the heart, flows thro' the lungs before the birth) to keep open those passages 'till the birth, there being after that time no other way of receiving nourishment? And are not the Fæces found in the guts of a Fœtus chiefly those parts of this fluid that were taken in at the mouth, and were too gross to enter the lacteals?

BESIDES these coats, in a cow and many other animals, we find another membrane called Allantois; it is inclosed by the Chorion together with the Amnion, and contains a large quantity of water which it receives from the bladder of urine by the Urachus. Its use seems to be to contain the urine that it might not by the common passage be emptied into the liquor of the Amnion, of which the Fœtus, I am inclined to think, is frequently drinking. Yet I own it takes off very much from the probability of the opinion of the Fœtus's imbibing this liquor, that, if I am rightly informed, some who have been born with mouths and nostrils unperforate, have had such fluids and excrements in the intestines that other Fœtus's have, which may indeed be derived from the salivary glands and from the liver, &c. The

1      following

following curious passage was sent me by Mr. Monro. " This liquor contributes nothing to  
 " the nourishment of the Fœtus for these reasons;  
 " first, because, as you have well observed, vast  
 " numbers of instances might be produced, where  
 " no passage was to be found for it: I shall give  
 " you one I saw my self in the Hotel de Dieu at  
 " Paris in 1718.

" Mary Guerlin brought forth two children,  
 " one a compleat girl, the other had neither  
 " head, neck, arms, heart, lungs, stomach, small  
 " guts, liver, spleen, nor Pancreas, yet the great  
 " guts, the organs of urine and generation of a  
 " female, and lower extremities were perfect,  
 " and of a natural growth; the umbilical vein,  
 " after entering the Abdomen split into a great  
 " many branches, which were distributed to the  
 " several parts in its Abdomen. Though it is  
 " true that soon after conception, the liquor in  
 " the Amnion, and that in the stomach of the  
 " Fœtus resemble one another pretty near, yet  
 " afterward they differ exceedingly, for the li-  
 " quor in the stomach is still gelatinous, thick,  
 " and without acrimony, while the other becomes  
 " thinner and more acrid; whereas, had the Fœ-  
 " tus constantly swallowed this liquor, the case  
 " would have been quite opposite; nay, often it  
 " has happened that these waters (as they are  
 " commonly called) have been found quite cor-  
 " rupted, strongly fetid, and extreamly sharp,  
 " while the Fœtus, except the injuries which the  
 " external parts received, was well and sound;  
 " witness the example mentioned by Bellinger,  
 " of

“ of a woman who was cured of a virulent Go-  
“ norrhea during her going with child. And  
“ farther by Malpighius’s delineations of the  
“ Pullus in Ovo, it appears to me evident that  
“ the Afitellus serves the same purpose as the  
“ Placenta does in viviparous animals, to con-  
“ vey the Albumen attenuated by incubation into  
“ the blood-vessels of the chick, and that none  
“ of the Albumen does pass through the Saccus  
“ Colliquamenti.”

WHETHER an Allantois is to be found with a human Fœtus or no, anatomists are not all agreed, and I cannot give my opinion having never had a sufficient opportunity to enquire. But children having an Urachus one cannot well doubt of the Allantois. I have been informed by a gentleman, whose probity I can sufficiently rely on, that he had seen a child that had no external genital parts, and made water through the navel. At Henley upon Thames, there is now living a bargeman’s child about ten years old, of which child I had the like account; but upon examination I found an unperforated Glans with its Frœnum immediately below the place of the navel, and the urine issued out by drops between this and the belly, in the place which I suppose was the navel, but it was so much excoriated, that I could make no certain judgment about it. In the Uterus of a cow with two calves, I found they had but one Chorion, but each an Amnion, and Allantois distinct, but the cotyledons which are analagous to the Placenta of the humane Fœtus,

tus, were pretty much in common to the umbilical blood vessels of both.

THE Placenta, or womb-liver, is a mass of blood vessels seated on the outside of the Chorion, being composed of the extrem branches of the umbilical-vein and arteries, which are for the composition of this part divided into exceeding small branches to join a like number of the menstrual vessels of the Uterus; which vessels of the Uterus are made numerous rather than large, that the separation of the Placenta from them may not be attended with a flux of blood fatal to the mother; for the sides of little vessels soon collapse and close, and they are more easily stopped, being compressed by the Uterus it self as it shrinks, which it begins to do from the time of the birth; but when the Placenta is separated before the delivery, whether untimely or not, these vessels bleed until the Uterus is discharged of the Fœtus. The figure of the Placenta is circular, and at its greatest growth about two inches thick, and six or seven diameter.

THE arteries and veins of the Uterus of the mother, by which the menstrual purgations are made, are joined to the umbilical arteries and veins in the Placenta of the Fœtus, the arteries of the Uterus to the veins in the Placenta, and the veins in the Uterus to the arteries of the Placenta: By these vessels a large quantity of blood is continually flowing from the mother to the Fœtus and back again; but for what end such a quantity flows continually and back again, I cannot conceive, unless it is that the Fœtus not  
breathing



breathing for it self, it is necessary that as much blood of the mother should flow continually to the Fœtus, as can leave enough air, or whatever our blood receives in the lungs for the Fœtus; and perhaps what nutritious juices the Fœtus receives, require a great deal of blood to convey them, they being but a small part of the blood. The navel-string or umbilical blood-vessels, between the Placenta and the navel, are about two foot long, that the Fœtus may have room to move without tearing the Placenta from the Uterus, which being done too soon, from whatever cause, occasions a miscarriage. These vessels, viz. two arteries and one vein twist about each other, particularly the arteries about the vein, and are contained in one common coat together with a vessel called Urachus, which arises from the top of the bladder of urine, and ends in the membrane Allantois; the umbilical vein goes Tab. xxxi. from the navel directly into the liver, and there <sup>1.</sup> enters the great trunk of the Vena Portæ. Near Tab. xxxi. which entrance, there goes out the Ductus Venosus <sup>2.</sup> to the great trunk of the Cava, which carries Tab. xxxi. part of the blood that is brought by the umbilical vein, that way into the Cava, while the rest <sup>4.</sup> circulates with the blood in the Porta, the whole of it not passing through the Ductus Venosus as is generally believed, but a great part of it into branches of the Porta, in the liver; otherwise there need be no communication between the umbilical vein and the Porta; and when the umbilical vein is stopped, it becomes a ligament, and the Ductus Venosus soon shrinks and almost disappears,

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appears, having no longer any blood flowing through it; and even the Porta it self within the liver (from whence only blood could pass after the birth into the Ductus Venosus) has less blood flowing through it for some time than it had before the birth, it receiving much blood before the birth from the umbilical vein. The blood which flows from the mother to the Foetus by the umbilical vein, is returned (all but a small quantity, which is reserved for nutrition) by the two umbilical arteries, which arise from the internal iliac arteries, and passing by the outsides of the bladder go directly to the navel and Placenta; these with the Urachus being shrunk up after the birth, lose much of their appearance, especially near the navel, where they are sometimes not to be distinguished.

PART of the blood before the birth and not the whole quantity, as is generally thought, which is brought by the ascending Cava to the right auricle, passes at once through the Foramen Ovale into the left auricle, and the rest flows into the right ventricle with the blood of the descending Cava, and thence into the pulmonary artery; where about one half flows into the lungs, and the other half directly into the Aorta by the Ductus Arteriosus, which lies between the pulmonary artery, and the Aorta, which after the birth is called Ductus Arteriosus in Ligamentum Versus. The better to explain this contrivance, I will call the quantity of blood flowing through the ascending Cava in a given time four, and that which flows through the descending Cava two: Then  
let

let two of the quantity in the ascending Cava flow into the right auricle, it will then with the two received from the descending Cava have the quantity four; which being thrown from the right ventricle into the pulmonary artery, the quantity two is thrown into the Aorta by the Ductus Arteriosus, and the same quantity into the lungs by the pulmonary branches; then the quantity returning from the lungs to the left auricle, will be two in the same given time, which being added to the two which flowed through the Foramen Ovale, in the same time there will be constantly the same proportions received into each ventricle at every Diastole of the ventricles, as after the birth. Now if the blood flowing through the ascending Cava joined by that from the umbilical vein, was but equal to that flowing through the descending, let each of them be called two, and let all the blood of the ascending Cava go through the Foramen Ovale; then the blood which the left ventricle would receive, would exceed that which flows into the right, by the whole quantity which flows from the lungs in the same time; but the ascending Cava conveying more blood than the descending Cava, the excess in the left ventricle would be yet greater. If the proportions which I have taken for the easier computing were perfectly right, as I am sure they are nearly, then the quantity flowing into the left ventricle, would be to that flowing into the right at the same time as five to two, if all the ascending blood went through the Foramen Ovale.

AND though after the birth the left ventricle of the heart is only employed in throwing blood into the Aorta, and the right wholly employed in circulating the blood through the lungs; yet before the birth all the blood thrown out by the left ventricle, and about half the blood thrown out of the right ventricle, being thrown into the Aorta, and the other part only through the lungs, it follows that the whole force exerted by the left ventricle, with about half that of the right, is employed in throwing blood into the Aorta, while that distributes blood through the whole Fœtus, and to the mother: But after the birth, when the blood is to be no longer carried from the Fœtus to the mother, the left ventricle becomes sufficient for the circulation through the Fœtus, and a new occasion immediately arises for that additional power, which before was necessarily employed in throwing blood into the Aorta; for the whole mass of blood now being to be circulated through the lungs, the Ductus Arteriosus closes, and the right ventricle must throw all the blood it receives into the lungs, there being no longer any passage into the Aorta. It is supposed that the inflation of the lungs at the birth, presently alters the position of the Ductus Arteriosus, so as to obstruct it; which account is indeed mechanical, but I think not true, because I can neither discern that the position of this vessel is altered, nor its surface compressed: But I rather think that immediately upon the birth, there being no blood carried off from the Fœtus to the mother, and the left ventricle being sufficient to

fill

fill the Aorta and its branches with blood, as I have shewn before, there is no longer room for any blood from the right ventricle; wherefore the blood from the right ventricle will be forced into the lungs, where the passage is now made easy, as I imagine, by their being inflated; and the Ductus Arteriosus, having the blood no longer forced into it, shrinks, and in time almost disappears. This duct being stopped, the valve of the Foramen Ovale immediately stops that passage, it being on the side of the left auricle (or that muscular bag, which is the largest part of that auricle) which is much the strongest, must at all times be pressed more on that side than the other by the blood in the time of the Systole of the auricle; and it is as evident that in the Diastole of the auricle, there must be more pressure to open that than the right, it being a stronger muscle, or else there could have been no reason for having the left auricle stronger than the right in proportion to their ventricles. Sometimes this valve does not quite cover the Foramen, in which case a small quantity of blood may possibly flow from the left auricle to the right, and so circulate twice through the lungs to once through the body, but none could flow from the right to the left and escape the lungs, which might be of bad consequence. Some have imagined, that men who have this passage open, cannot be drowned: But though this passage is sometimes found open, no Man has been yet seen, that we have ever heard of, that could not be drowned. I have seen the Foramen open in a man that was hanged, to



whom one might justly expect it should have been as useful as in the case of submerſion in water. Many writers have ſuppoſed that this Foramen is open in amphibious animals, and in ſuch fiſhes as have two auricles, two ventricles and lungs like land animals, without gills (which in other fiſh are analogous to lungs.) I have diſſected a porpus which is of this kind, and found this Foramen cloſed; but the great veins were vaſtly large in proportion to the bulk of the animal; whence I conjectured their blood was accumulated in their veins, while they kept under water, and by that means the lungs eſcaped being oppreſſed with blood; which conjecture ſeemed to me the more probable, ſince all animals of this kind are able to abide the leaſt time under water, when their blood is moſt expanded with heat. But upon the diſſection of an otter, whoſe Foramen Ovale was alſo cloſed, I found the veins nothing differing from thoſe of other animals. In a water tortoiſe which I had an opportunity of examining, with that moſt dextrous and indefatigable anatomist Dr. Douglafs, I found the two ventricles of the heart but half divided by a Septum, and in the beginning of the pulmonary artery ſeveral ſtrong muſcular rings, a little diſtance from each other, each of which by contracting, would be capable of reſiſting a part of that blood, which otherwiſe would have been thrown into the lungs, when they were under water; and this blood ſo obſtructed muſt neceſſarily be thrown into the Aorta, the two ventricles being in a manner one common cavity; and when they are out of the water, this communication



nication of ventricles, will suffer but little confusion of the blood which flows into the ventricles, because each ventricle receiving and discharging the same quantity of blood, at the same time, they will balance each other, and thereby such a mixture will be very much prevented. Mr. Monro observes, that the water tortoise has very large lungs, consisting of larger vesicles than land animals, and that they receive a greater quantity of air to furnish that *Je ne sçai quoi* so necessary for the life of animals: The same thing I remember to have observed in frogs.

As to the reason of womens bringing forth at the usual time; it has been said, that at that time, the head of the child begins to be specifically heavier than the rest of the body, and therefore must fall lowest in the fluid it lies in; which being an uneasy posture, makes the child struggle, and bring on the labour. But it is not true, that the head then alters its specific gravity; or if it did, there is seldom fluid enough in the Amnion for this purpose; and besides, this could only happen right in one posture, and would always happen wrong in brutes.

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## C H A P. IV.

### *Of the eye.*

**T**HE figure, situation, and use of the eyes, together with the eye-brows, eye-lashes, and eye-lids, being well known, I think, I need only describe what is usually shewn by dissecting. The orbit of the eye, or cavity in which it is contained, is in all the vacant places filled with a loose fat, which is a proper medium for the eye to rest in, and serves as a socket for it to be moved in. In the upper and outer part of the orbit, is seated the lacrymal gland. Its use is to furnish at all times water enough to wash off dust and to keep the outer surface of the eye moist, without which the Tunica Cornea would be less pellucid, and the rays of light would be disturbed in their passage; and that this liquor may be rightly disposed of, we frequently close the eye-lids to spread it equally, even when we are not conscious of doing it. At the inner corner of the eye, between the eye-lids, stands a caruncle, which seems to be placed to keep that corner of the eye-lids from being totally closed, that any tears or gummy matter may flow from under the eye-lids, when we sleep, or into the Puncta Lacrymalia, which are little holes, one in each eye-lid,

lid, near this corner, to carry off into the Ductus ad Nasum, any superfluous tears.

THE first membrane of the eye is called Conjunctiva, it covers so much of the eye as is called the white, and being reflected all round it lines the two eye-lids; it being thus returned from the eye to the inside of the eye-lids; it effectually hinders any extraneous bodies from getting behind the eye, into the orbit, and smooths the parts it covers, which makes the friction less between the eye and the eye-lids. This coat is very full of blood vessels, as appears upon any inflammation.

TUNICA SCLEROTIS, and CORNEA, make together one firm case of a proper form, for the use of the other coats and humours. The forepart of this strong coat being transparent, and like horn, is called Cornea, and the rest Sclerotis. Under the Cornea lies the Iris which is an opaque membrane, like the Tunica Choroides, but of different colours in different eyes, such as the eye appears, as grey, black, or hazel, for it being seated under the Tunica Cornea, it gives such an appearance to that as it has its self. The middle of it is perforated for the admission of the rays of light, and is called the pupil. Immediately under the Iris lie the Processus Ciliares, like radial lines from a lesser circle to a greater. When these processes contract, they dilate the pupil to suffer more rays of light to enter into the eye; and the contrary is done by the circular fibres of the Iris, which act as a sphincter muscle: But these changes are not made with great quickness, as appears  
from

from the eyes being oppressed with a strong light, for some time after we come out of a dark place, and from the contrary effect in going suddenly from a light place to a dark one. And as the pupil always dilates in darker places, to receive more rays of light; so when any disease makes some of those rays ineffectual, which pass through the pupil, it dilates as in dark places to admit more light; therefore a dilated pupil is a certain sign of a bad eye, and this may be discerned usually sooner than the patient discerns any defect in vision. In men the pupil is round, which fits them to see every way alike; it is also round in animals that are the prey both of birds and beasts. But graminivorous brutes that are too large to be the prey of birds, have it oblong horizontally, which fits them to view a large space upon the earth; while animals of the cat-kind, who climb trees, and prey indifferently on birds or animals that hide in the earth, have their pupils oblong the contrary way, which fits them best to look upward and downward at once. Besides these there are other animals whose pupils are in these forms, but in less proportions, so as best to fit their ways of life. Immediately under the Sclerotis, is a membrane of little firmness, called Choroides; in men it is of a rusty dark colour, such as will bury almost all the rays of light, that pass through the Tunica Retina, which if it were of a brighter colour, would reflect many of the rays upon the Retina, and make a second image upon the first somewhat less, and less distinct, but both together stronger; which

is



is the case of brutes of prey, where a great part of this coat is perfectly white, which makes them see bodies of all colours in the night better than men, for white reflects all colours: But brutes that feed only on grass, have the same parts of this membrane of a bright green, which enables them also to see with less light, and makes grass an object that they can discern with greatest strength: But these advantages in brutes, necessarily destroy great accuracy in vision, which is of little or no use to them, but to men of great consequence. This green part of the Tunica Choroides, in animals that graze, may properly be called *Membrana Uvea*, from its resemblance in colour, to an unripe grape. But in men's eyes, only a white circle round the back side of the Choroides near the Cornea, is called *Uvea*.

IMMEDIATELY under the Tunica Choroides, lies the Tunica Retina, which is the optic nerve expanded and co-extended with the Choroides. Rays of light striking upon this membrane, the sensation is conveyed by the optic nerves, to the common Sensorium the brain; these nerves do not enter at the middle of the bottom of the eyes, but nearer the nose; for those rays of light being ineffectual for vision that fall upon the entrance of the optic nerves, it is fit they should so enter, as that the same object, or part of any object, should not be unperceived in both eyes, as would have been the case, had they been otherwise inserted; which appears from a common experiment of part of an object being lost to one eye, when we are looking towards it  
with



with the other shut. I know a gentleman who having lost one eye by the small-pox, and going through a hedge a thorn unseen (probably from this cause) struck the other and put it out. The two optick nerves soon after they arise out of the brain join and seem perfectly united, yet from the following case, I am not without suspicion of their fibres being preserved distinct, and that the nerve of each eye, arises wholly from the opposite side of the brain, or else that the other nerves throughout the body arise from the brain, and Medulla Oblongata on the sides opposite to those they come out of. A soldier who was my patient in the hospital about five years since, had, by a push with a broad sword, his left eye rased out of the orbit, which I replaced with my fingers; it was presently followed with excessive pain in the right side of the head only, and a loss of the sense of feeling and motion in both the right limbs; the sense of feeling he recovered by degrees in about a month, and soon after, began to recover their motion, but was about twelve months before he could walk, and lift up his hand to his head; and in about two years recovered all but the sight of the wounded eye, which indeed did not appear perfect. In fish these nerves arise distinct from the opposite sides of the brain, and cross without uniting; but as these animals have their eyes so placed, as not to see the same object with both eyes at once, whereas animals whose optic nerves seem to unite, do see the same object with both eyes at once, one would suspect that in one they were joined.

joined to make the object not appear double, and in the other distinct, to make their two eyes (as they are to view different objects at the same time) independent on each other; and yet from the following cases, the seeing objects single seems not to depend upon any such union, nor from the light striking upon corresponding fibres of the nerves, as others have believed, but upon a judgment from experience, all objects appearing single to both eyes in the manner we are most used to observe them, but in other cases double; for though we have a distinct image from each eye sent to the brain, yet while both these images are of an object seen in one and the same place, we conceive of them as one, so when one image appears to the eyes (when they are distorted or wrong directed) in two different places, it gives the idea of two; and when two bodies are seen in one place, as two candles rightly placed, through one hole in a board, they appear one. But cases of this kind being too numerous, I will conclude with one very remarkable, and I think much in favour of this opinion. A gentleman who, from a blow on the head, had one eye distorted, found every object appear double, but by degrees the most familiar ones became single, and in time all objects became so, without any amendment of the distortion.

THE inside of the eye is filled with three humours, called aqueous, crystalline and vitreous. The aqueous lies foremost, and seems chiefly of use to prevent the crystalline from being easily bruised by rubbing or a blow, and perhaps it

serves for the crystalline humour to move forward in while we view near objects, and backward for remoter objects; without which mechanism, or in the place of it a greater convexity in the crystalline humour in the former case, and a less convexity in the latter, I do not imagine, according to the laws of optics, how we could so distinctly see objects at different distances. However it is in land animals, I think we may plainly see, that fish move their crystalline humour, nearer the bottom of the eye when they are out of water, and the contrary way in water; because light is less refracted from water through the crystalline humour than from air. Some have said, that amphibious animals have a membrane like the Membrana Nictitans of birds, which serves them as a Lens in the water. I have examined the eye of a crocodile, which Sir Hans Sloan keeps in spirits, and I found this membrane equally thick and dense, and consequently unfit for this purpose, or I believe any other except that obvious one, of defending the eye from the water. Next behind the aqueous humour lies the crystalline; its shape is a depressed spheroid, it is distinctly contained in a very fine membrane called Aranea. The use of this humour is to refract the rays of light which pass through it, so that each pencil of rays from the same point of any object, may be united upon the Retina (as in a Camera Obscura) to make the stronger impression; and though by this union of the rays a picture inverted is made upon the Retina, yet surely it is the impulse only of the rays upon the Retina, that is  
the

the cause of vision; for had the colour of the Retina been black, and consequently unfit to receive such a picture, would not the impulse of light upon it have been sufficient for vision? Or would such a picture, if it could have been made without any impulse, have ever conveyed any sensation to the brain? Then if the impulse of light upon the Retina, and not the image upon the Retina, is the cause of vision; when we enquire why an image inverted in the eye appears otherwise to the mind, might we not expect to find the true cause from considering the directions in which the rays strike the Retina, as we judge of above and below from a like experience, when any thing strikes upon any part of our bodies; nevertheless in viewing an object through a Lens, we conceive of it as inverted, when as in receiving the impulses of light in the same manner, and having the picture on the Retina in the same attitude, when we stand on our heads without the Lens, we have not the same, but the contrary idea of the position of the object. Though I have considered this humour only as a refractor of light, yet the first and greatest refraction is undoubtedly made in the Cornea; but it being Concavo-convex, like glasses of that kind, while one side makes the rays of light converge, the other diverges them again. The same thing also may be observed of the aqueous humour, which is indeed more concave than convex; but when the crystalline humour is removed in the couching a cataract the aqueous possesses its place and becomes a Lens; but that refracting light less than the crystalline,



stalline, whose place and shape it partly takes, the patient needs a convex glass to see accurately. In some eyes either this humour being too convex or too distant from the Retina, the rays unite too soon unless the object is held very near to the eye; which fault is remediable by a concave glass, as the contrary fault (common to old persons) is by a convex glass. Here it may not be improper to observe, how wisely providence has fixed the distance, at which we ordinarily see objects best; for if the eye had been formed for a nearer view, the object would often obstruct the light; if it had been much farther, light enough would not commonly have been produced from the object to the eye. In fish the crystalline humour seems a perfect sphere, which is necessary for them, because light being less refracted from water through the crystalline humour than from air, that defect is compensated by a more convex Lens. The vitreous humour lies behind the crystalline, and fills up the greatest part of the eye: Its foreside is concave for the crystalline humour to lodge in; and its backside being convex the Tunica Retina is spread over it; it serves as a medium to keep the crystalline humour and the Retina at a due distance.

THE larger animals having larger eyes, their organs of vision (like a microscope with a large Lens) are fit to take in a greater view, but in that view things are not so much magnified; so in the lesser animals a small space is discerned, such as is their sphere of action, but that greatly magnified, not really so in either case, but comparatively;



paratively ; for vision shews not the real magnitude of objects, but their proportions one to another. Fish have their eyes, and particularly their pupils, larger than land animals, because there is less light, and that not so far distributed in water as in the air.

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## C H A P. V.

*Of the ear.*

**T**HE figure and situation of the outer ear, needs no description. Its inner substance is cartilage, which preserves its form without being liable to break : Its use is to collect sounds, and direct them into the Meatus Auditorius, which is the passage that leads to the drum ; this passage is lined with a glandular membrane, in which also is some hair ; the Cerumen which is separated by these glands, being spread all over this membrane, and its hairs, serve to defend the membrane from the outer air, and to entangle any insect that might otherwise get into the ear. Sometimes this wax being separated in too great quantity, it fills up the passage and causes deafness ; and those great discharges of matter from the Meatus Auditorius, which are commonly called impostumes in the ear, I think can be nothing else than ulcerations, or great secretions from these glands. At the farther end of the Meatus Auditorius lies the drum, which is extended upon a bony ridge almost circular : Its situation in men and brutes is nearly horizontal, inclined towards

the Meatus Auditorius, which is the best position to receive sounds; the greatest part of which being ordinarily reverberated from the earth. In its common situation in men and brutes, it is concave outward, but in birds it is convex outward, so as to make the upper side of it nearly perpendicular to the horizon, which serves them better to hear each others sounds when they are high in the air, where they can receive but little reverberated sound. This membrane does not entirely close the passage, but has on one side a small aperture covered with a valve. I found it once half open in a man that I dissected, who had not been deaf, and I have seen a man smook a whole pipe of tobacco out through his ears, which must go from the mouth, through the Eustachian tube, and through the Tympanum, yet this man heard perfectly well. These cases occasioned me to break the Tympanum in both ears of a dog, and it did not destroy his hearing, but for some time he received strong sounds with great horror. And that most excellent anatomist Mr. St. Andre, to whom I am greatly obliged in this chapter, has assured me, that a patient of his had the Tympanum destroyed by an ulcer, and the auditory bones cast out, without destroying his hearing. In very young children I have always found this membrane covered with Mucus, which seems necessary to prevent sounds from affecting them too much, there being no provision to shut the ears, as there is for the eyes. A gentleman well known in this city, having had four children born deaf, was advised to lay blisters upon the  
heads

heads of the next children he might have, which he did to three which were born afterward, and every one of them heard well. It seems not unreasonable to suppose that too great a quantity of this Mucus upon the drum, might be the cause of deafness in the four children, and that the discharge made by the blisters in the latter cases, was the cause of their escaping the same misfortune.

IN TO the middle of the Tympanum is extended a small bone called Malleus, whose other end is articulated to a bone called Incus, which is also articulated by the intervention of an exceeding small one called Orbiculare, to a fourth bone called Stapes. These bones are contained in that cavity behind the Tympanum, which is called the barrel of the ear; but some anatomists call the barrel only Tympanum, and the membrane Membrana Tympani. The Malleus being moved inward by the Musculus Obliquus Internus, or Trochlearis, it extends the Tympanum that it may be the more affected by the impulse of sounds when they are too weak. This muscle arises from the cartilaginous part of the Eustachian tube, and passing from thence in a proper groove, it is reflected under a small process, and thence passes on perpendicular to the Tympanum, to be inserted into the handle of the Malleus, sometimes with a double tendon. Parallel to this muscle lies another Extensor of the Tympanum, called Obliquus Externus; it arises from the outer and upper part of the Eustachian tube, and passing through the same hole with the Corda Tympani,

U 2

which

which is a branch of the fifth pair of nerves, it is inserted into a long process of the Malleus: This is not so obvious an Extensor as to be known to be so, without an experiment. The muscle which relaxes this membrane is called *Externus Tympani*; it arises from the upper part of the auditory passage under the membrane which lines that passage, and is inserted into the upper process of the Malleus. The relaxation of the Tympanum is made by this muscle, without our knowledge, when sounds are too strong; and as the pupil of the eye is contracted, when we have too much light, and dilated where there is too little, from what cause soever, so when sounds are too low, or the sense of hearing imperfect, from whatever cause, the extensors of the Tympanum stretch it, to make the impulse of sounds more effectual upon it, just as in the case of the common drum, and the cords of any musical instrument. From the cavity behind the Tympanum, which is called the barrel of the ear, goes the Eustachian tube, or *Iter ad Palatum*; it ends cartilaginous behind the palate. This passage seems to be exactly of the same use with the hole in the side of the common drum, that is to let the air pass in and out from the barrel of the ear, to make the membrane vibrate the better, and perhaps in the ear (which is closer than a common drum) to let air in or out as it alters in density, and if any fluid should be separated in the barrel of the ear to give it a passage out. This passage being obstructed, as it is sometimes, by a large Polypus behind the Uvula, it causes great difficulty of hearing,

hearing, and sometimes, when the Meatus Auditorius is obstructed, a man opening his mouth wide, will hear pretty well through this passage, which is often so open as that syringing water through the nose, it shall pass through into the barrel of the ear and cause deafness for some time. If any one would try how he can hear this way, let him stop his ears, and take between his teeth the end of a wire, or cord that will vibrate well, and holding the other end, strike it, and the sound that he hears will be through this passage. To the Stapes there is one muscle called Musculus Stapedis; it lies in a long channel, and ending in the Stapes, it serves to pull the Stapes off of the Fenestra Ovalis, which otherwise it covers. Besides the Fenestra Ovalis, there is another near it somewhat less, called Rotunda; these two holes lead to a cavity called Vestibulum, which leads into other cavities aptly called Cochlea, and three semicircular canals or altogether the labyrinth, in which are spread the auditory nerves to receive and convey the impulse of sounds, to the common Sensorium the brain; and surely the Chorda Tympani, which is a branch of the fifth pair of nerves may also convey these sensations to the brain. The two holes called Fenestra Ovalis & Rotunda, are closed with a fine membrane like the membrane called the drum, and the larger being occasionally covered and uncovered by the Stapes, sounds are thereby made to influence more or less, as best serves for hearing, and this advantage, being added to that of a lax or tense Tympanum, the effect of sounds may be greatly en-



creased or lessened upon the auditory nerves, expanded in the labyrinth. In the strongest sounds, the Tympanum may be lax, and the Fenestra Ovalis covered, and for the lowest the Tympanum tense and the Fenestra uncovered. If sounds propagated in the air were heard less, we might often be in danger before we were apprized of it, and if the organs of hearing were much more perfect, unless our understandings were so too, we should commonly hear more things at once than we could attend to.

## C H A P. VI.

### *Of the senses of smelling, tasting and feeling.*

THE sense of smelling is made by the Effluvia, which are conveyed by the air to the nerves, ending in the membranes which line the nose and its Lamellæ. In men these Lamellæ are few, and the passage through the nose not difficult; hence fewer Effluvia will strike the nerves, than in animals of more exquisite smell, whose noses being full of Lamellæ, and the passage for the air narrow and crooked, few of the Effluvia escape one place or another, besides their olfactory nerves may be more sensible. Fish, though they have no noses, yet in their mouths they may taste Effluvia in the water, as surely those fish do, who seek their prey in the darkest nights, and in  
great

great depths of water, there being more nerves disposed in their mouths, than through their whole bodies beside, the optic excepted; and it looks as if it was done for this purpose; for the mere sense of tasting, is ordinarily less curious in them, than in land animals; in baiting eel baskets, if the bait has lain long in water, it is seldom taken, but upon scarifying it afresh, which will make it emit new effluvia, it serves as a fresh bait.

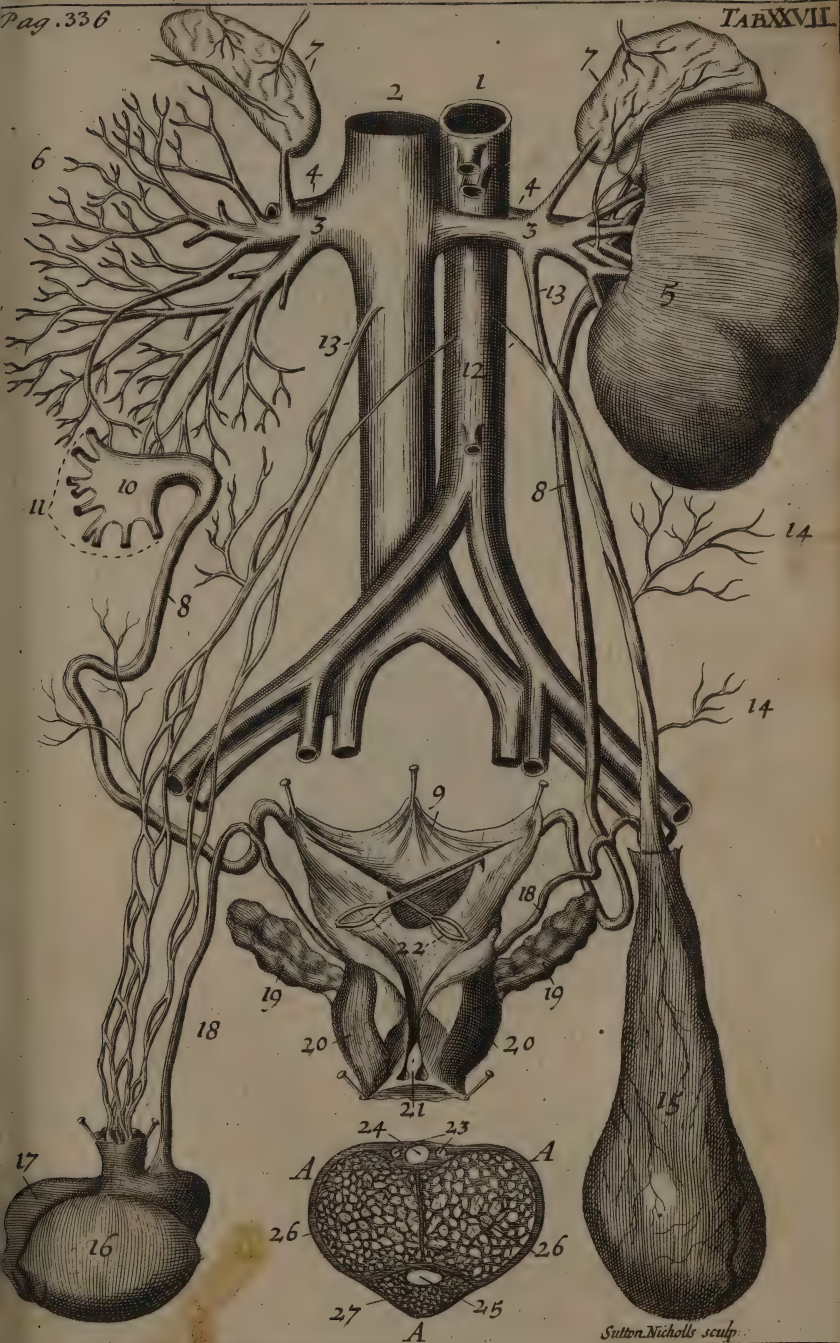
THE sense of tasting is made in the like manner upon the nerves, which line the mouth, and so is that of feeling upon the nerves, distributed throughout the body; of which, I should speak largely in this place, if I had not done it already in the chapter of the nerves.



## T A B L E XXXIV.

*The urinary and genital parts of a man.*

1. ARTERIA Aorta Descendens.
2. Vena Cava Ascendens.
- 3, 3. The emulgent veins.
- 4, 4. The emulgent arteries.
5. The left kidney.
6. The emulgent vein taken out of the right kidney.
- 7, 7. Glandulæ Renales.
- 8, 8. The Ureters.
9. Part of the bladder of urine.
10. The Pelvis of the right Ureter taken out of the kidney.
11. The Tubuli Urinarii taken out of the right kidney.
12. The spermatic arteries.
13. The spermatic veins, the right entering the Cava, and the left the emulgent.
- 14, 14. Collateral branches of the spermatic vein, which on this side are not laid bare, and separated from the artery which runs in the same membrane with it.
15. The left testicle included in the Processus Vaginalis or Elythroides.
16. The right testicle denuded.
17. The right Epididymis.
- 18, 18. The Vasa Deferentia.
- 19, 19. The Vesiculæ Seminales.







20, 20, The Prostatae.

21. The Rostrum Gallinaginis in the Urethra.

22. Two probes put into the ureters, to shew their oblique passage into the bladder of urine.

A, A, A transverse section of the Penis prepared with Mercury.

23. The two arteries of the Penis.

24. The Vena Ipsius Penis.

25. The Urethra.

26, 26. The Corpora Cavernosa Penis.

27. The Corpora Cavernosa Urethræ.

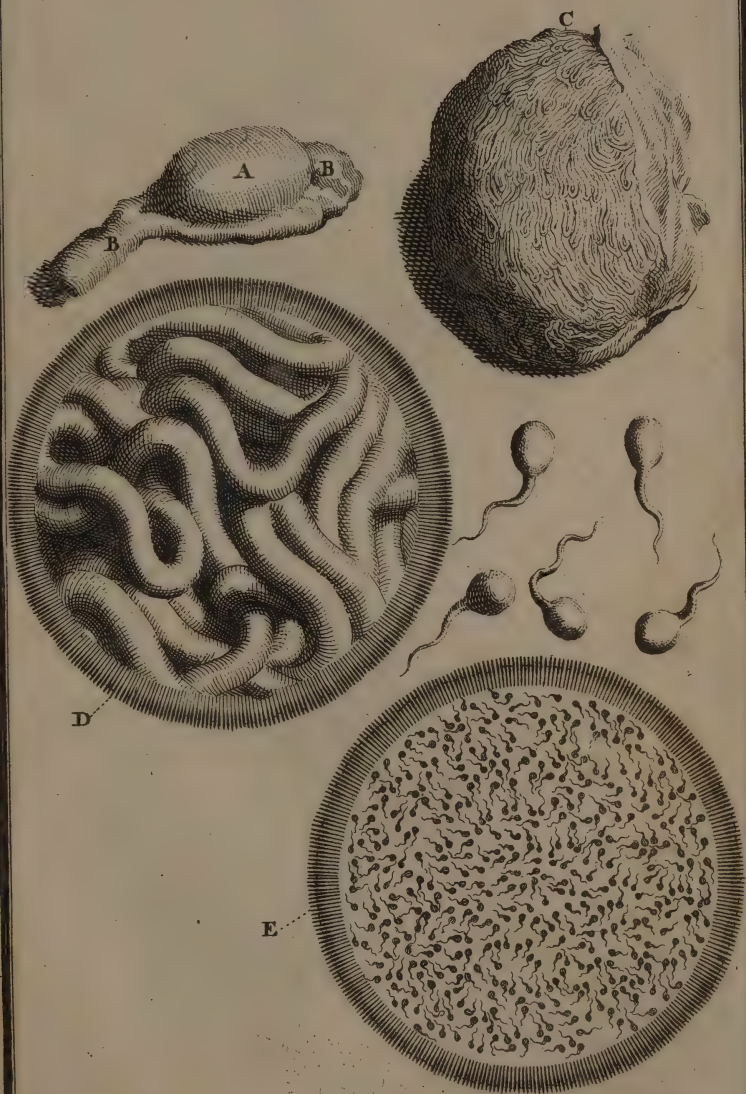


T A B L E

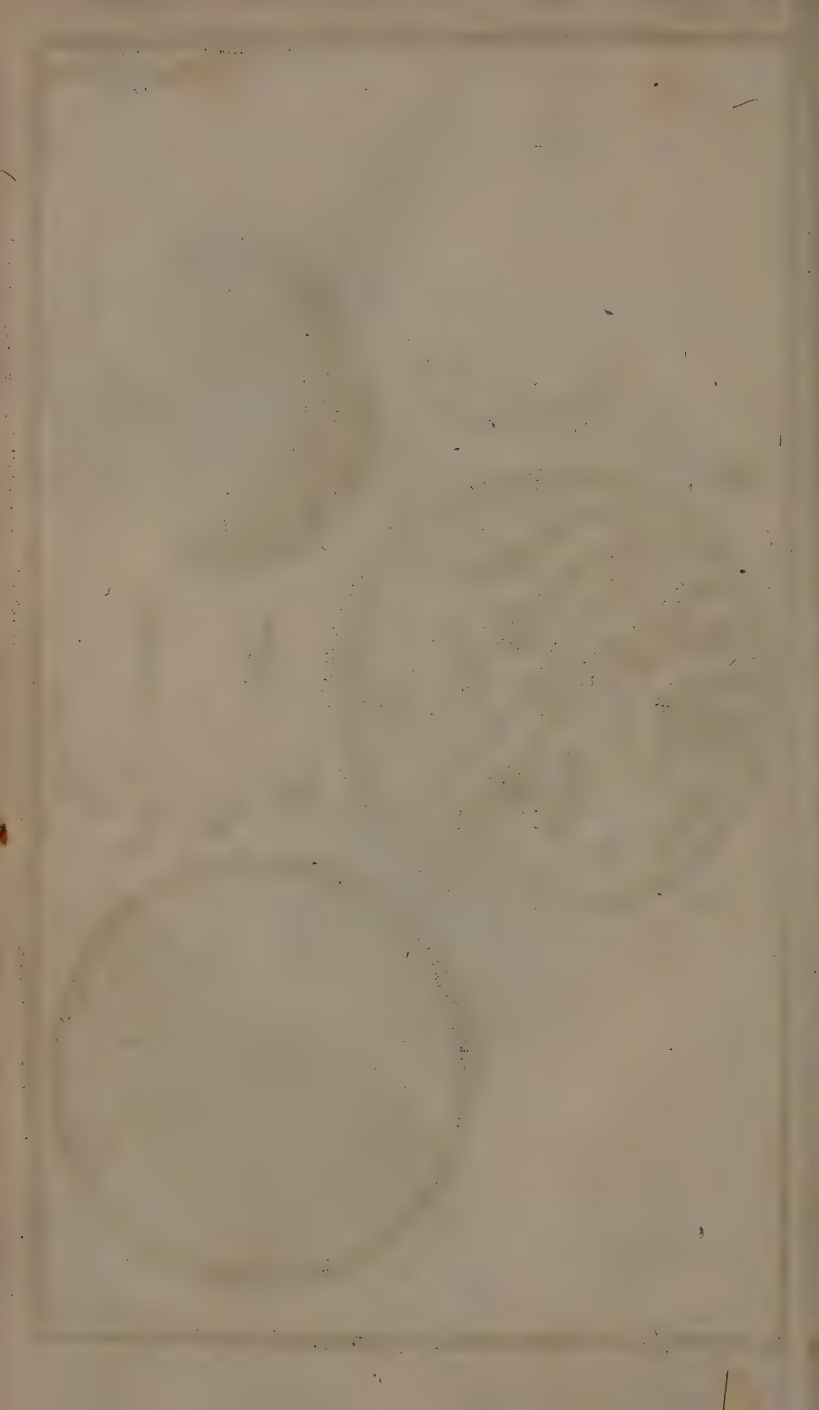
## TABLE XXVIII.

- A. THE testicle of a rat.  
B, B. The Epididymis.  
C. The same testicle divested of the Tunica Albuginea, and magnified to shew the Convolutions of the vessels.  
D. An inward portion of the same testicle more magnified.  
E. A Group of Animalculæ, as they appear in the male seed in a microscope, and five other besides more magnified, but not represented enough like Tadpoles.

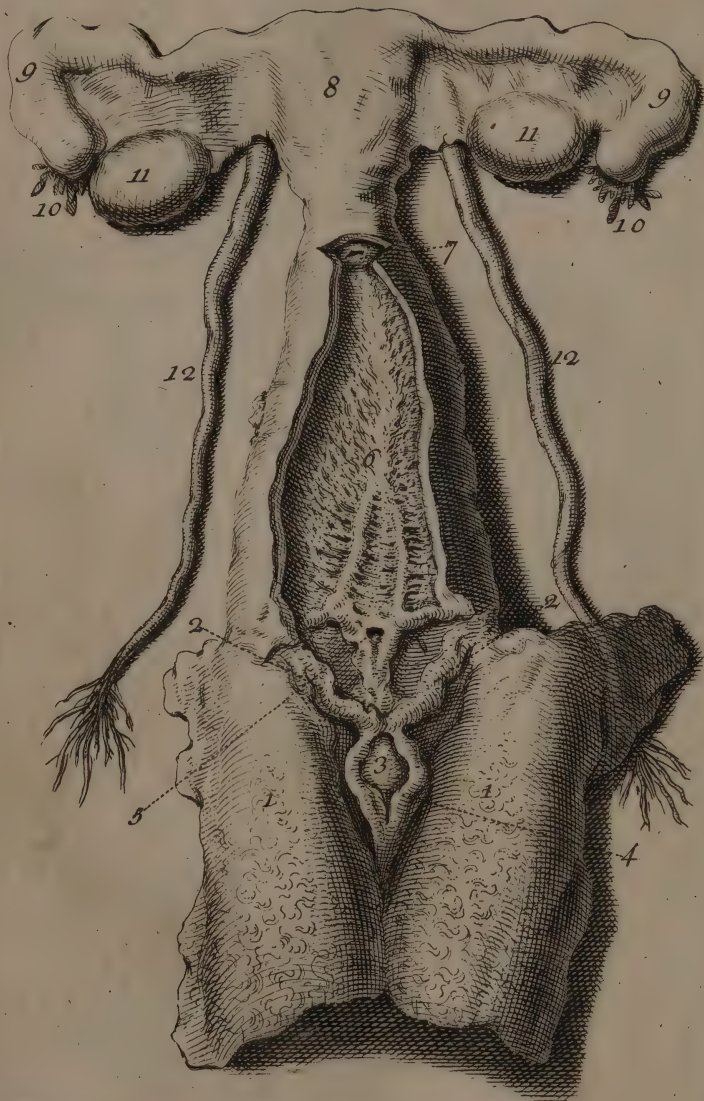












## T A B L E XXIX.

THE parts of generation in women, the lower side of the Vagina being laid upward, and cut open.

- 1, 1. The Labia.
- 2, 2. The Nymphæ.
3. The Glans of the Clitoris extremely large.
4. The Præputium of the Clitoris.
5. The orifice of the Meatus Urinarius.
6. The inside of the Vagina where the Rugæ are to be seen.
7. Os Tincæ.
8. Uterus.
- 9, 9. Tubæ Fallopianæ.
- 10, 10. Fimbriæ.
- 11, 11. Ovaria.
- 12, 12. Ligamenta Rotunda.





## T A B L E    X X X.

REPRESENTS the parts of an hermaphrodite, in which appeared as much of the mixture of the sexes as could be; (but Dr. Douglas, to whom I am obliged for this cut, and the references, esteems it a female.) I once examined another, in which I found a divided Scrotum just like the Labia Pudendi, with testicles in it, and a urinary passage between them, with a perfect Clitoris as large as a Penis, with an exceeding small Urethra, through which came a little urine.

## FIGURE I.

1. The Clitoris covered with its Præputium.
- 2, 2. The two Labia Pudendi.

## FIGURE II.

3. The Clitoris covered with its Præputium.
4. The Glans of the Clitoris.
- 5, 5. The Nymphæ.
- 6, 6. The Labia turned back, to shew the entrance into the Vagina marked 7.
8. The Furca Virginalis, or the skin that joins the two Labia at their lower part.

Fig. I.

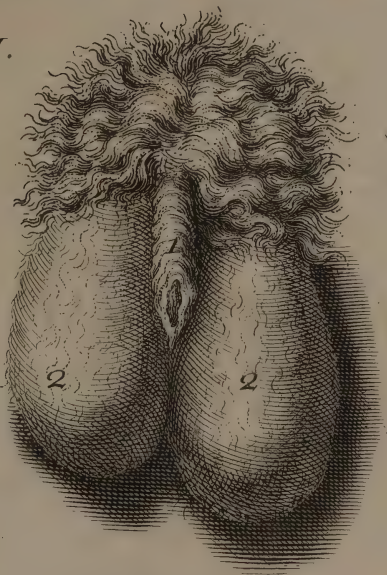


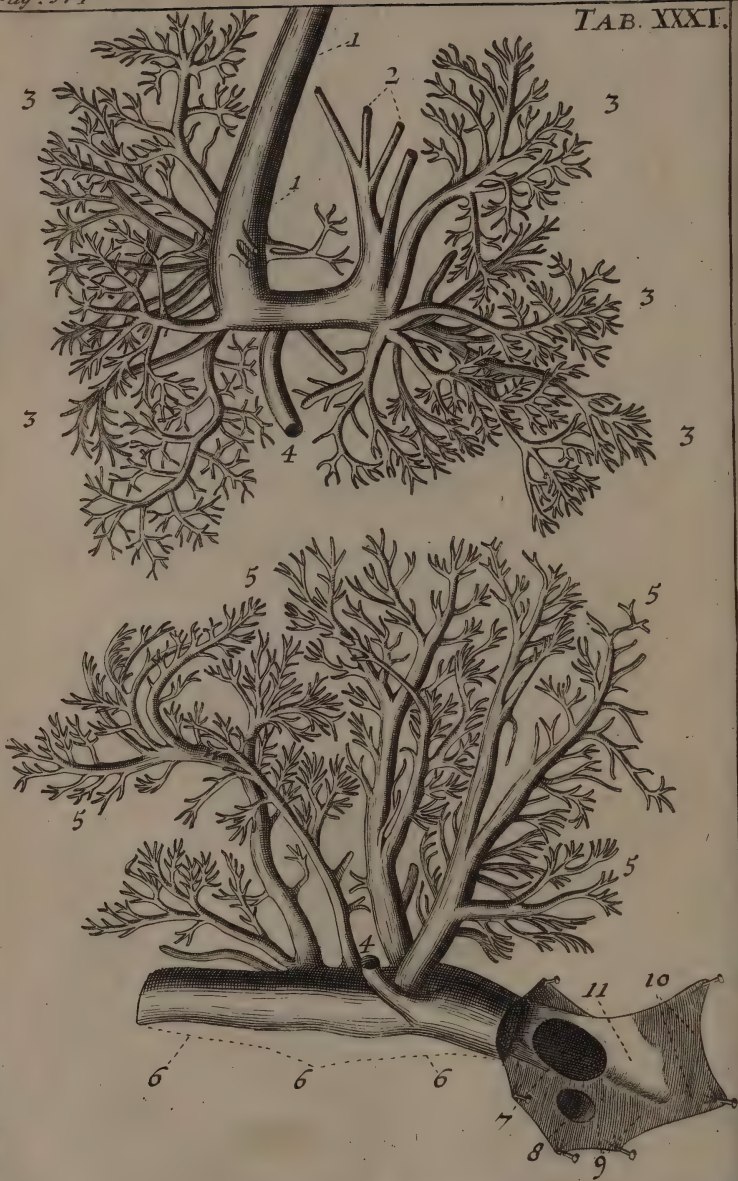
Fig. II.











## T A B L E XXXI.

*The vessels of the liver, &c. of a Fœtus, filled with wax.*

- 1, 1. The umbilical vein.
2. Branches of the Vena Portæ.
- 3, 3, &c. The extream branches in the liver.
- 4, 4. The Ductus Venosus.
- 5, 5, &c. The extreme branches of the Cava in the liver.
- 6, 6, 6. The ascending Vena Cava.
7. The Foramen Ovale.
8. The mouth of the coronary veins.
9. Part of the right auricle of the heart.
10. Part of the descending Cava.
11. Tuberculum Loweri.



TABLE

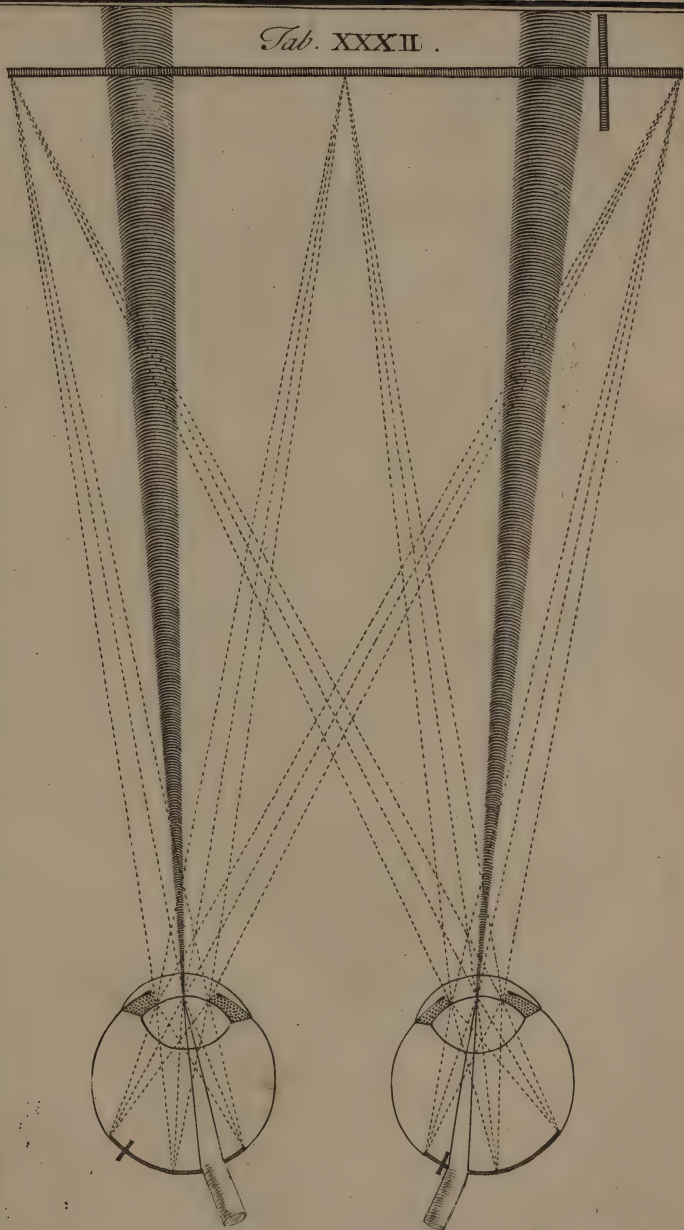
## T A B L E XXXII.

SHEWS how all the rays that flow from any point of any object, through the pupils of the eyes, are refracted by the crySTALLINE humour, to meet in a Focus upon the Retina; the two dark cones shew the spaces where any object being placed, it is not perceived in that eye in which the cone ends; because all the rays of light from an object so placed, fall upon the entrance of the optic nerve in that eye. (Vid. page 213.) These cones divaricating as they proceed from the eyes, they can never coincide, and consequently, tho' an object may be from this cause undiscerned by one eye, there is no place from which it will be upon this account undiscerned by the other eye.



T A B L E

Tab. XXXII .

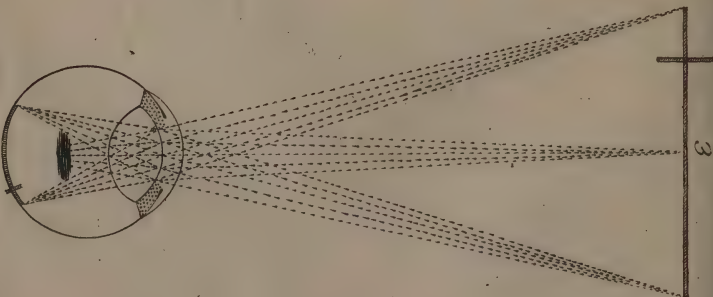
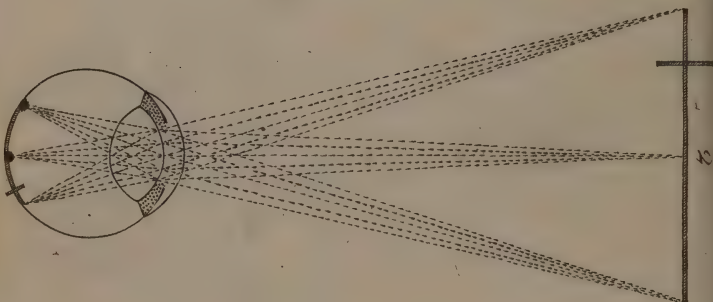
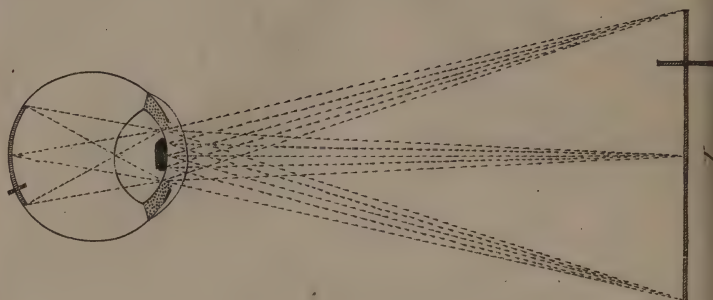








Tab. XXXIII.



## T A B L E XXXIII.

## FIG. 1

SHEWS what will be the effect of an opakeness, in the forepart of the crystalline humour.

## FIG. 2

SHEWS what will be the effect, when parts of the Retina are not sensible of the light that falls upon them.

## FIG 3.

SHEWS what will be the effect of opakeness in the vitreous humour.

BY considering the effects of diseases within the eyes in this manner, the situation and extent of a disease in the eyes may, in most cases, be known to great exactness.





## TABLE XXXIV.

## FIG. 1

SHews how the light may be perceived only side-ways, when as much of the Tunica Cornea is become opake as lies before the pupil.

## FIG. 2

SHews how it happens that in the case of a cataract, which is a disease in the crySTALLINE humour, light is perceived side-ways after vision is quite lost forwards.



TABLE

Fig. 1

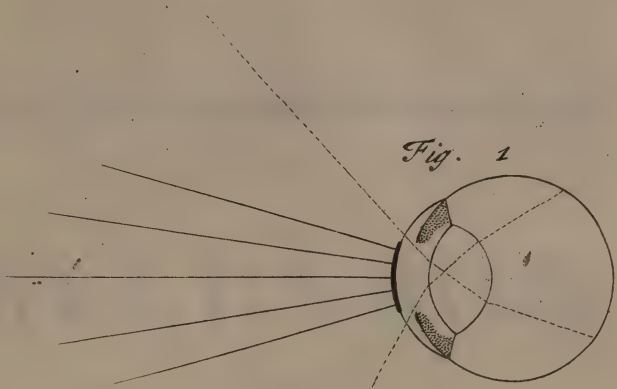
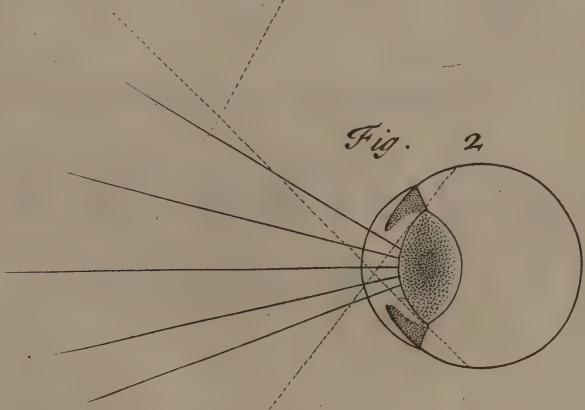


Fig. 2







# SYLLABUS,

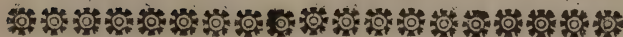
S I V E

I N D E X

Humani Corporis partium præcipuarum

# ANATOMICUS,

In xxxv Prælectiones distinctus.









# OSTEOLOGIA.

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## Prælectio Prima.

### *De Articulationibus & Structura Ossium.*

**D**iarthrosis { Enarthrosis.  
                   { Ginglimus.  
 Synchondrosis.  
 Synarthrosis, { Sutura.  
                   { Gomphosis.

---

## Prælectio Secunda.

### *De Ossium textura, Membranisque, &c.*

In Textura sunt observanda { Fibræ.  
   { Partes { compactæ.  
   {           { spongiosæ.  
 Membranæ, { Pericranium.  
                   { Periosteum.  
                   { Glandulosæ Cellulas investientes.  
                   { Medullam continentes.

X 2

Medulla

Medulla { adiposa.  
              { sanguinea.

De { Epiphyſibus, & Apophyſibus in genere.  
Introitu & exitu Vaſorum.  
Offium nutritione & incremento.

## Prælectio Tertia.

*De Suturis & Ossibus Cranii.*

Sutura { Coronalis.  
Sagittalis.  
Lambdoidalis. — *Ossa Triquetra.*  
Squamosa.  
Transversalis.

*Cæteræ ab Offibus, quæ circumagunt, nominantur.*

OS,  
Bregmatis.

Frontis, { Spina.  
Foramina.  
Sinus.

Ethmoides, { Crista Galli.  
Foramina.

Processus { Ptery- { externus.  
              goides { internus.  
              Innominatus.  
              Salpingoides.  
              Clinoides.

Sphenoides, Sella Turcica.

Foramen { primum.  
secundum, vel lacerum.  
tertium.  
quartum.  
quintum.

Sinus Sphenoidalis.

# Temporis

Temporis, { Processus Mammillaris.  
 { Processus e quo fit Os Jugale dictum.

Petrosum, { Foramen { sextum.  
 { septimum.  
 { Processus Styliformis.

*Meatus auditorius, &c. Vide, de Organis Auditus,*  
*Præl. xxv.*

Foramen octavum.

Occipitis, { Foramen { nonum.  
 { decimum, vel magnum.  
 { Apophyses duæ.

*Foramina quædam Innominata.*

## Prælectio Quarta.

*De Ossibus Faciei, & Maxillarum, &c.*

OS,

Nasi.

Unguis, — ductus ad Nasum.

Planum.

Malæ vel Zygoma.

Palati, — Foramina.

Vomer.

*Spongiosum & septum Nasi quid.*

Maxilla	{	Superior,	{ Alveoli.	
			{ Foramina.	
			{ Antrum.	
	{	Inferior,	Processus	
			{	Foramina.
				Alveoli.

{ Condylodes.  
 { Coronalis.  
 { Innominatus.

Dentes

Dentes { Incisorii.  
Canini.  
Molares.  
Sapientiaë.

## Prælectio Quinta.

### *De Ossibus Trunci Corporis.*

Spina, ejus Vertebrae.	{	Colli 7.	{	partes anteriores spongiosæ.		
		Atlas prima.		Processus	{	Obliqui superiores.
		Dentata secunda.				Obliqui inferiores.
		Processus dentatus.				Spinales bifurcati.
				Transversi perforati.		
	{	Dorsi 12.	{	partes anteriores spongiosæ.		
		Lumborum. 5.		Processus	{	Obliqui superiores.
						Obliqui inferiores.
						Spinales.
		Transversales.				
		Sacri 5, vel 6.	{	Spinæ.		
			{	Foramina.		
			{	Processus obliqui superiores.		
		Coccygis 4, vel 5.				
		Costæ 12.	{	veræ 7.	Apophyses, & Sulci.	
			{	nothæ 5.		
		Sternum	{	Ossa Pectoris, plerumque tria.		
			{	Cartilago ensiformis.		
			{	Cartilagine ad Costas.		
		Os Hyoides,				

## Prælectio Sexta.

*De Ossibus artus superioris.*

OS,  
Clavicula.

Scapula, { Acetabulum.  
 { Processus { Coracoides.  
                   { Acromion.  
 { Costa { Superior.  
           { Inferior.  
 { Spina.  
   Basis.  
 { Caput.  
 { Apophysis superior.  
 { Sulcus.  
 { Apophysis { externus, } inferior.  
                   { internus, }  
 { Sinus.

Ulna, { Olecranon.  
 { Processus Styloides.

Radius, ——— Tuberculum.

Carpi { primi } ordinis 4.  
       { secundi }

Metacarpi 4.

Pollicis 3.

Digitorum 12.



## Prælectio Septima.

*De Ossibus artus inferioris.*

OS,

Innominatum,	{	Ilium,	{ Spina.
			{ Apex.
		Ischium—	Processus { obtusus.
			{ acutus.
	{	Pubis.	
		Acetabulum.	
		Foramen.	

Femoris,	{	Caput.	
		Trochanter	{ major.
			{ minor.
		Linea aspera.	
	{	Apophyses inferiores.	

Patella.

Tibia, Apophyses.

Fibula,	—	Appendix	{ superior.
			{ inferior.

Tarsi 7.	{	Astragalus.
		Calcaneum.
		Cuboides.
		Naviculare.

{	Cuneiforme	{ majus.
		{ medium.
		{ minimum.

Metatarfi 4.

Pollicis pedis 3.

Digitorum pedis 12.

Sesamoidea.

## Prælectio Octava.

*De Ligamentis, & Cartilaginibus Capita ossium investientibus, & Glandulis Ossium, juncturis inservientibus: Etiam de his quibus Skeleton Viri, & Fæminæ Fœtus, & Adulti differunt.*

De { Ligamentis in genere.  
Ligamento terete.  
Cartilaginibus in genere.  
Glandulis juncturas lubricantibus.





# ENTEROLOGIA.

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## Prælectio Nona.

*De quibusdam Partium externarum integumentisque & Partibus constituentibus.*

Mammæ, { Papillæ.  
Areolæ.

Scrobiculus Cordis.

Regio Umbilicalis.

Hypochondria.

Hypogastrium.

*Cæteræ partes externæ propriis Prælectionibus sunt demonstrandæ.*

Cuticula.

Reticulum mucosum.

Cutis, { Papillæ Pyramidales. — Ungues.  
Bulbi, unde procedunt — Pili.

Glandulæ miliares, vel sudoriferæ.

Membrana adiposa.

Fibra.

Nervus.

Musculus.

Membrana.

Glandula.

Tendo.

Arteria.

Vas { Lacteum.

Os.

Vena.

{ Excretorium.

Cartilago.

Lymphæ-ductus.

Ligamentum.

Prælectio

## Prælectio Decima.

*De Membranis totius Corporis.*

Dura Mater.	Pleura.
Pia Mater.	Peritoneum, &c.
Mediastinum.	

## Prælectio Undecima.

*De Glandulis salivalibus, earumq; ductibus.*

Parotides, vel Maxillares superiores.	} earum ductus.
Maxillares inferiores.	
Sublinguales.	
Tonfillæ.	
Membrana Glandularis oris, cujus Glandulæ nominantur	{ Buccales. Labiales. Linguales. Fauciales. Palatinæ. Uvulares.

## Prælectio Duodecima.

*De Ductu Alimentali, & Membranis in Abdomine.*

Peritoneum ——— Vasa Umbilicalia. *Vide Præl. xxii.*

Omentum,

Omentum, { Ala, { superior.  
                  { Bursa. { inferior.

Œsophagus.

Ventriculus,—orificum { finistrum, Cardia.  
                                  { dextrum, ubi circulus  
  fibrosus.

Intestina tenuia, { Duodenum.  
                          { Jejunum.  
                                  { Ilium.

Intestina { Colon, ubi Valvulæ ad ingressum.  
crassa, { Cæcum.  
          { Rectum.

*In omni parte ductus Alimentalis est notanda,*

Tunica { externa, Communis.  
          { media, Muscularis.  
          { interna, Glandulosa, Villo obducta.

In { Ventriculo flaccido, Rugæ.  
  { Intestinis { tenuibus, Valvulæ Conniventes.  
                  { crassis, Cæco excepto, { Ligamenta,  
  { Glandulæ.  
  { Valvulæ.

Mesenterium,—Glandulæ { Majores, in Canibus  
  { Pancreas Asellii.  
  { Minores.

*In omnibus his Membranis, sunt observandæ Lamellæ.*



## Prælectio Decima Tertia.

*De Hepate, Pancreate, Splene & Via lactea.*

Hepar,	{	Ligamentum	{	Suspenforium.
				Latum.
				Umbilicale.
	{	Vena	{	Porta.
				Cava.
	Ductus Venosus.			
		Vesica Fellea.		
	{	Vasa ex-	{	Cysticus.
cretoria,		Ductus		Hepaticus.
				Communis.
				Choledochus.

Pancreas — Ductus excretorius.

Splen, { Rete.  
Cellulæ.

## Prælectio Decima Quarta.

*De quibusdam Glandulis, & de Vasis lacteis & lymphaticis.*Venæ lacteæ, { primi } generis.  
                          { secundi }

Receptaculum chyli.

Ductus Thoracicus.

Lymphæductus in genere.

Glandulæ { Vasa ubique concomitantes.  
                  { Inguinales.  
                  { Axillares.

Prælectio

## Prælectio Decima Quinta.

*De Corde, & partibus Respirationi inservientibus.*

- Larynx, — Cartilago { Thyroides.  
Cricoides.  
Arytænoides.  
Epiglottis.
- Bronchos, — Cartilagines, Pene-anulares.
- Glandulæ Thyroideæ.
- Thymus.
- Pleura.
- Mediaſtinum.
- Pulmones, { Lobi.  
Lobuli.
- Pericardium.
- Cava { descendens.  
ascendens.
- Tuberculum Loweri.
- Cor { Auricula { Columnæ.  
dextra { Foraminis ovalis locus.  
Oſtium Venarum coronariarum.
- Ventriculus dexter, { Valvulæ tricuspides.  
Papillæ.  
Columnæ.
- Arteria Pul- { Valvulæ ſigmoidales.  
monalis, { Canalis arterioſus in Liga-  
mentum verſus.
- Vena Pulmonalis.
- Auricula ſiniſtra, — Columnæ.
- Ventriculus ſiniſter, { Valvulæ mitrales.  
Papillæ.  
Columnæ.
- Septum Cordis.
- Aorta,

Aorta, { Valvulæ femilunares.  
 { Ostia Arteriarum coronariarum.

## Prælectio Decima Sexta.

### *De Arteriis & Venis superioribus.*

#### ARTERIÆ.

Aorta ascendens.  
 Coronariæ Cordis.  
 Subclaviæ.  
 Thymæ.  
 Mammariæ.  
 Cervicales.  
 Carotides.  
 Thyroideæ.  
 Laryngæ.  
 Temporales.  
 Occipitales.  
 Parotides.  
 Ranulæ.  
 Faciei.

#### VENÆ.

Jugulares, { externæ.  
 { internæ.  
 Rami communicantes.  
 Ranulares.  
 Faciei.  
 Parotides.  
 Laryngæ.  
 Thyroideæ.  
 Mammariæ.  
 Thymæ.  
 Occipitales.  
 Cervicales.  
 Subclaviæ.  
 Cava descendens.

*Vasa Cerebri.* Vide Præl. xviii.

Axillaris.  
 Humeralis.  
 Cubitalis { superior.  
 { media.  
 { inferior.  
 Ramus communicans.  
 Digitales.

Digitales.  
 Cephalica.  
 Mediana.  
 Basilica.  
 Humeralis.  
 Axillaris.

Prælectio Decima Septima.  
*De Arteriis, & Venis inferioribus.*

## ARTERIÆ.

Aorta descendens.  
 Intercoſtales.  
 Bronchiales.  
 Phrenicæ.  
 Cœliaca.  
 Pancreatica.  
 Hepatica.  
 Cyſtica.  
 Coronaria Ventriculi ſuperior.  
 Epiploicæ.  
 Splenica.  
 Coronaria Ventriculi inferior.  
 Meſenterica ſuperior.  
 Emulgentes.  
 Spermaticæ.  
 Lumbares.  
 Meſenterica inferior.  
 Rami communicantes.  
 Sacra.  
 Iliaca { externa.  
           { interna.  
 Epigaſtricæ.  
 Cruralis.  
 Tibialis { anterior.  
           { media.  
           { poſterior.  
 Ramus communicans.  
 Digitales Pedis.

## VENÆ.

Digitales Pedis.  
 Saphena.  
 Tibiales.  
 Popliteæ.  
 Cruralis.  
 Epigaſtricæ.  
 Iliaca { externa.  
           { interna.  
 Lumbares.  
 Spermaticæ.  
 Emulgentes.  
 Meſeraicæ.  
 Coronaria Ventriculi inferior.  
 Splenica.  
 Epiploicæ.  
 Coronaria Ventriculi ſuperior.  
 Cyſtica.  
 Hepatica.  
 Pancreatica.  
 Porta.  
 Phrenicæ.  
 Intercoſtales.  
 Bronchiæ.  
 Azygos in Cavam deſcendentem.  
 Cava aſcendens.  
 Earum Valvæ.

Tunicæ, & Vaſa Vaſorum.

Prælectio

## Prælectio Decima Octava.

*De Cerebro, ejusque Membranis, & Vasis.*

Dura Mater	Processus	primus, (i. e.) Falx.	ubi Liga- menta. Torcular Herophili.
		secundus.	
		tertius.	
	Sinus	Longitu- dinalis	
		Laterales.	
		Rectus.	
		Circularis. Innominati.	

*Cæteri non sunt semper observandi.*

Pia Mater	Arteriæ.	
	Venæ.	
	Valvulæ.	
Cere- brum.	Hemisphæra 2.	
	Lobi 4.	
	Arteriæ	Carotides.
		Cervicales.
	Infundibulum.	
	Glandula pituitaria.	
	Protuberantiæ 2. albæ pone infundibu- lum.	
	Medulla ob- longata,	Crura.
		Caudex.
	Protuberantia annularis.	
Nervo- rum par	{ 1 2 3 4 5 }	Olfactorium.
		Opticum.
		Oculorum motorium.
		Patheticum.
		Gustatorium.



Cerebrum. } Nervorum par }  $\left. \begin{array}{l} 6 \\ 7 \\ 8 \\ 9 \\ 10 \end{array} \right\} \begin{array}{l} \text{seu Auditorium.} \\ \text{seu vagum.} \\ \text{Accessorius Recurrens.} \end{array}$

Cerebellum, — Processus vermiformes.

Substantia } Corticalis cinerea.  
Medullaris alba.

Septum lucidum.

Fornix, } Radices.  
Crura.

Ventriculi 2 anteriores, }  $\left. \begin{array}{l} \text{Plexus Choroides.} \\ \text{Glandula Pinealis.} \\ \text{Corpora striata.} \\ \text{Thalami Nervorum opticom.} \\ \text{Nates.} \\ \text{Testes.} \end{array} \right\}$

Foramen }  $\left. \begin{array}{l} \text{ad Radices Fornicis.} \\ \text{anterius.} \\ \text{posterius.} \end{array} \right\}$

Ventriculus tertius.

Ventriculus quartus. }  $\left. \begin{array}{l} \text{Valvula.} \\ \text{Pedunculi.} \end{array} \right\}$

*Quod de Cerebro superest vix notatu dignum iudico.*

## Prælectio Decima Nona.

*De Medulla Spinali & Nervis passim in Corpore dispersis.*

Medulla Spinalis }  $\left. \begin{array}{l} \text{Meninges.} \\ \text{Cauda Equina.} \\ \text{Nervor. pares. } \left\{ \begin{array}{l} \text{Cervicis 7.} \\ \text{Dorsi 12.} \end{array} \right. \end{array} \right\}$

Medulla

Medulla Spinalis { Nervor. { Lumborum 5.  
                              { pares. { Sacri 6.

Brachiales.

Cubitales.

Digitales.

Intercoſtales.

Cruralis { anticus.  
              { poſticus.

Tibiales.

Digitorum pedis.

*Sunt plurimi ex his oriundi, & per Corpus undique  
dispersi; & a partibus quibus subserviunt nomi-  
nantur.*

## Prælectio Vigesima.

*De Partibus Urinariis, & Organis generatio-  
nis in Viris.*

Renes, { Arteriæ } emulgentes.  
          { Venæ }  
          { Glandulæ.  
          { Papillæ.  
          { Tubuli Urinarii.  
          { Pelvis.

Glandulæ Renales. — Sinus.

Ureteres.

Vesica uri- } Externa communis.  
naria, } Tunica { Media, Musculus detractor u-  
          {            { rinæ.  
          { Interna,

Testes,	Tunicæ	{	Communes,	{	externa, Cutis.
				{	interna, Dartos.
		{	Propriæ	{	externa, Processus Elythroides.
				{	interna, Albuginea.
	Arteriæ	{	Spermaticæ,		
				Venæ	
Corpora varicosa.					
Epididymes.					

Vasa deferentia.

Vesiculæ feminales.

Prostatae.

Penis,	{	Glans,	{			Præputium.			
			{			Frœnum.			
			{			Corpora cavernosa. ¶			
			{			Glandulæ odoriferæ.			
	{	Crura.							
		Corpora cavernosa.							
		Septum.							
		Connexio ad Offa pubis, ( <i>i. e.</i> ) Ligamentum suspensorium.							
	{	Urethra.	{			Corpus cavernosum.			
			{			Rostra Gallinaginis.			
			{			Membrana Glandulosa.			

*Musculi: Vide Præl. xxvi.*

## Prælectio Vigesima Prima.

*De Partibus Generationis Mulierum.*

Externæ,	{	Mons Veneris.
		Rima Magna.
		Labia.
		Nymphæ.
	{	Glans.
		Præputium.
		Crura.
		Corpora cavernosa.
	{ Meatus Urinarii exitus.	
Vagina,	{	Hymen.
		Carunculæ myrtiformes.
		Rugæ.
		Glandulæ.
Uterus,	{	Lacunæ.
		Ligamenta.
		Os Tincæ.
Tubæ Falloppianæ,	{	Fimbriæ.
		Foramina.
Ovaria,	{	Arteriæ
		Venæ
		spermaticæ.
		Corpora varicosa.
	{ Ova.	

## Prælectio Vigesima Secunda.

*De Fœtu in Utero, cum Membranis, &c.*

Membrana	{	Chorion.
		Allantois.
		Amnion.

Humores.

Placenta Uterina.

Vasa Umbilicalia, { Vena.  
Arteriæ.  
Urachus.

Ductus v

Foramen OVALE.

Ductus arteriosus.

## Prælectio Vigesima Tertia.

*De Organis Tactus, Gustus, & Odoratus.*

### TACTUS.

Papillæ pyramidales in Cute. *Vide Præl. ix.*

### GUSTUS.

Papillæ pyramidales in Lingua.

### ODORATUS.

Membrana Glandulosa, & Nervea, passim indurata in Laminas Nasi, commune Os spongiosum dictum.

## Prælectio Vigesima Quarta.

*De Organis Visus.*

Palpebræ cum Ciliis, & Superciliis.

Caruncula lachrymalis.

Ductus lachrymales.

Tunica



Conjunctiva.  
 Sclerotis.  
 Cornea.  
 Tunica { Choroides.  
           Uvea.  
           Retina.  
           Aranea.  
 Processus Ciliares.  
 Iris.  
 Pupilla.  
 Humores, { Aqueus.  
               Vitreus.  
               CrySTALLINUS.

## Prælectio Vigesima Quinta.

### *De Organis Auditus.*

Auricula.  
 Meatus Auditorius. — Membrana Glandulosa.  
 Iter ad Palatum.  
 Tympanum.  
 Membrana Tympani.  
 Fenestra { ovalis.  
               rotunda.  
 Vestibulum.  
 Labyrinthus. { Cochlea.  
                   Canales tres semicirculares.  
 Offa, { Incus.  
           Stapes.  
           Malleolus.  
           Officulum quartum.  
 Musculus { externus, Tympani laxator.  
               Obliquus internus } extensores.  
               Obliquus externus }  
               Stapedis.



# MYOLOGIA.

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## Prælectio Vigesima Sexta.

### *De Musculis Abdominis, &c.*

Fascia tendinosa, *vulgo* Membrana communis  
Musculorum.

Membrana propria.

### ABDOMINIS.

Obliqui	{	descendentes.	}	Compressores.
		ascendentes.		
Pyramidales, —		<i>sæpe desunt.</i>		
Recti, —		flexores.		
Transversales.				
Cremasteres Testium.				
Erectores Penis.				
Acceleratores Urinæ.				
Erectores Clitoridis.				
Sphincter Vaginæ.				
Sphincter Ani.				
Levatores Ani.				

Prælectio Vigesima Septima.

*De Musculis Faciei, Oculi, &c.*

FRONTIS.

Occipito-Frontalis.  
Retractor Auriculæ.

PALPEBRARUM.

Orbicularis.  
Ciliaris, *est portio prioris.*  
Aperiens Palpebram superiorem rectus.

Oculi.

Elevator.  
Depressor.  
Adductor.  
Abductor.  
Obliquus { superior, seu Trochlearis.  
              { inferior.

FACIEI.

Sphincter Oris.  
Elevator } Labii superio- { Dilator } alarum  
Depressor } ris proprius est { Constrictor } Nasi.  
Elevator } Labii inferioris proprius.  
Depressor }  
Elevator } Labiorum communis.  
Depressor }  
Zygomaticus.  
Buccinator.  
Platysma Myoides.

## Prælectio Vigesima Octava.

*De Musculis Ossis Hyoidis, Linguae, & Laryngis.*

## OSSIS HYOIDIS.

Mylohyoidei, }  
 Geniohyoidei, } fursum, antrorsumque.  
 Stylohyoidei, — fursum, retrorsumque.  
 Coracohyoidei, — deorsum, retrorsumque.  
 Sternohyoidei, — deorsum.

## LINGUÆ.

Genioglossi, — fursum, antrorsumque.  
 Styloglossi, — fursum, retrorsumque.  
 Ceratoglossi, }  
 Basioglossi, } deorsum.

## LARYNGIS.

Hyothyroidei, — elevatores }  
 Sternothyroidei, } depressores. } Thyroidis.  
 Cricothyroidei, }  
 Cricoarytæ- { postici, }  
                   noidei, { laterales, } apertores } Arytænoïdis.  
 Thyroarytænoidei, }  
 Arytænoidei — clausores.

## Prælectio Vigesima Nona.

*De Musculis Maxillæ inferioris, Pharyngis, & Uvulæ.*

## MAXILLÆ INFERIORIS.

Digastricus, ——— depressor.

Masseteres,

Temporales,

Pterygoidei  $\left\{ \begin{array}{l} \text{externi,} \\ \text{interni,} \end{array} \right\}$  elevatores.

## PHARYNGIS.

Stylopharyngei, ——— dilatatores.

Œsophagei, ——— constrictores.

Vaginalis Gulæ.

## UVULÆ.

Pterygostaphylini  $\left\{ \begin{array}{l} \text{externi, ——— deorsum,} \\ \text{interni, ——— sursum.} \end{array} \right\}$

Glossostaphylini.

## Prælectio Trigesima.

*De Musculis Claviculæ, Scapulæ, Humeri, & Cubiti.*

## CLAVICULÆ.

Subclavius.

## SCAPULÆ.

Trapezius ——— retrorsum.

Elevator.

Rhomboides, sursum, retrorsumque.

Serratus



Serratus {major }anti- {antrorsum, fursumque.  
 {minor }cus, {antrorsum, deorsumque.

Pectoralis, ——— antrorsum.

Deltoides, } fursum.

Supraspinalis, }

Infraspinalis, retrorsum.

Teres {major.  
 {minor est per Musc. infrasp. } retrodeor-  
 sum.

Latissimus Dorsi.

Coracobrachialis, ——— fursum, extrorsumque.

Subscapularis, ——— introrsum.

## CUBITI.

Biceps, } Flexores.  
 Brachialis, }

Triceps, } Extensores.  
 Anconeus, }

## Prælectio Trigesima Prima.

*De Musculis Volæ Manus, Carpi, Pollicis,  
 Digitorum, & Radii.*

## VOLÆ MANUS.

Palmaris {longus, sæpe deest.  
 {brevis, seu caro quadrata.

## CARPI.

Flexor {Radialis.  
 {Ulnaris.

Extensor {Radialis, seu Bicornis.  
 {Ulnaris.

*Pollicis.*

## POLLICIS.

Extensor { primi  
          { secundi } internodii.  
          { tertii }  
Flexor { primi, & secundi Ossis.  
          { tertii internodii.  
Adductor.  
Abductor.

## DIGITORUM.

Perforatus, — secund. }  
Perforans, — tert. } internod. flexor.  
Lumbricales, — primi }  
Extensor { Communis.  
          { Indicis.  
          { Auricularis.  
Abductor { primi } digiti.  
          { minimi }  
Flexor Ossis Metacarpi minimi digiti.  
Interossei, — extensores, & divaricatores.

## RADII.

Supinator { longus flexor verus cubiti.  
          { brevis.  
Pronator { teres.  
          { quadratus.

## Prælectio Trigesima Secunda.

*De Musculis Capitis, & Colli.*

## CAPITIS.

Mastoidei,

Recti	{	interni	{	majores	}	flexores.
		minores				
laterales—utrinque.						

## COLLI.

Longi, — flexores.

Scaleni.

Intertransversales.

## CAPITIS.

Splenii.

Complexi.

Recti	{	majores	}	extensores.
		minores		

Obliqui	{	superiores	}	—rotatores.
		inferiores.		

## COLLI.

Spinales

Transversales	{	extensores.
Interspinales		

## Prælectio Trigesima Tertia.

*De Musculis Dorsi, Lumborum, & Costarum.*

## DORSI.

Sacrolumbales,	{	extensores.
Longissimi,		
Semispinales,		

*Lumborum.*

## LUMBORUM.

Psoas parvus, — flexor sæpe deest.

Quadrati, — utrinque.

Coccygei.

## COSTARUM.

Serrati { superiores, } postici { levatores.  
                  { inferiores, } { depressores.Intercostales { externi, } levatores.  
                          { interni, }Triangulares, } constrictores.  
Diaphragma, }

## Prælectio Trigesima Quarta.

*De Musculis Femoris, & Tibiæ.*

## FEMORIS.

Psoas magnus, }  
Iliacus internus, } flexores.  
Pectineus, }  
Triceps, }Gluteus { maximus, }  
          { medius, } extensores.  
          { minimus, }Pyriformis, } seu { Iliacus externus, }  
Marfupialis, } { Obturator internus, } rotatores.  
Quadratus. }  
Obturator externus.

## TIBIÆ.

Membranofus, — extensor extrorsum.

Sartorius, } flexor introrsumque.  
Gracilis, }Semitendinosus, }  
Semimembranosus, } flexores.  
Biceps, }  
Popliteus, }

Rectus.

Rectus,  
 Vastus, { externus, } extensores.  
           { internus, }  
 Crureus,

---

### Prælectio Trigesima Quinta.

*De Musculis Tarfi, Pollicis, & Digitorum Pedis.*

#### TARSI MUSCULI.

Gastrocnemius externus, }  
 Plantaris *sæpe deest* } extensores.  
 Gastrocnemius internus, }  
 Tibialis { anticus, — flexor } introrsum.  
           { posticus, — extensor }  
 Peroneus { longus, } extensores extrorsum.  
           { brevis, }

#### POLLICIS PEDIS.

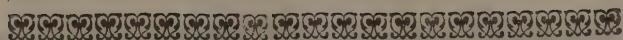
Extensor { longus.  
           { brevis.  
 Flexor { longus.  
           { brevis.  
 Abductor.  
 Adductor.

#### DIGITORUM PEDIS.

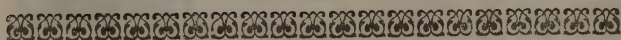
Extensor { longus.  
           { brevis.  
 Interossei — extensores.  
 Perforatus, — secund.  
 Perforans, — tert. } internod. flexores.  
 Lumbricales, — prim.  
 Transversalis Pedis — constrictor.

F I N I S.





A N  
*A P P E N D I X*  
T O T H E  
F O U R T H E D I T I O N  
O F T H E  
A N A T O M Y  
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# APPENDIX.

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## CHAP. I.

*A short historical account of cutting for the stone.*



THE most ancient way of cutting for the stone, is that described by Celsus, now called cutting by the gripe, or the lesser apparatus; and as Celsus relates, was not performed in his time but upon boys between nine and fourteen years of age. But Rossset, in his treatise de partu Cesareo says, he thinks this must be a mistake in the manuscript from which Celsus was printed, seeing younger boys are well known to be much fitter subjects for

that operation: But this way of operating is very difficult in men, and perhaps attended with inconveniencies if it has ever been practised, that the operators have not thought fit to publish.

IN the year 1524 Marianus published the method of cutting by the greater Apparatus, (now commonly called the old way) which was invented by his master Johannes de Romanis; this operation has one advantage over the former, that it may be done conveniently upon men full grown.

IN the year 1697 Frere Jacques came to Paris (as Mery and others have related) to practise his new invented way of cutting for the stone, which he declared to be directly into the bladder, and which he had performed with so great reputation, that the king ordered him to cut in both the hospitals, where though some of his patients recovered surprisingly, yet the major part miscarrying, his operation fell presently into disgrace. Upon opening these unhappy patients (as Mery and others relate) in some the bladders were found cut through, and wounded in many places; in some the neck of the bladder totally divided, and in others the Intestinum Rectum miserably cut, which upon the whole sufficiently shewed, that the ill success of this operation was not owing to the nature of it, but the operator's ignorance in anatomy, as they themselves insinuate.

IN the year 17 $\frac{1}{3}$  Doctor James Douglass, in a paper presented to the Royal Society, demonstrated from the anatomy of the parts, that the high operation for the stone might be practised; which

(which had been once performed by Franco injudiciously, and by him disrecommended, though his patient recovered; and afterwards strongly recommended, but not practised by Roffet.) Yet no one undertook it, till his Brother Mr. John Douglass about three Years after performed it, and with great Applause, his two first patients recovered: Soon after a surgeon of St. Thomas's Hospital cut two, who both recovered; but the same gentleman afterwards cutting two, who miscarried by the cutting or bursting the Peritoneum, so that the guts appeared, this way immediately became as much decryed, as it was before commended; and the Surgeons of St. Bartholomew's Hospital who had resolved to do this operation, altered their resolution, and went on in the old way. The next season it being my turn in St. Thomas's, I resumed the high way, and cutting nine with success, it came again in vogue; after that every Lithotomist of both Hospitals performed it; but the Peritoneum being often cut or burst, (twice in my practice) though some of these recovered, and sometimes the bladder it self was burst from injecting too much water, which generally proved fatal in a day or two. Another inconvenience attended every operation of this kind, which was, that the Urine's lying continually in the wound sometimes made sloughs, and always retarded the cure, but then it was never followed with an incontinence of urine; what the success of the several operators was, I will not take the liberty to publish; but for my own, exclusive of the two before



mentioned, I lost no more than one in seven, which is more than any one else that I know of could say ; whereas in the old way, even at Paris, from a fair calculation of above 800 patients, it appears that more than two in seven died. And though this operation came into universal discredit, I must declare it is my opinion, that it is much better than the old way, to which they all returned, except my self, who would not have left the high way but for the hopes I had of a better, being well assured that it might hereafter be practised with greater success; these fatal accidents having pretty well shewn how much water might be injected, and how large the wound might safely be made: But hearing of the great success of Mr. Rau, professor of anatomy at Leyden, I determined to try, though not in his manner, to cut directly into the bladder; and as his operation was an improvement of Fryar James, I endeavoured to improve upon him by filling the bladder, as in the high way, with water, leaving the Catheter in, and then cutting on the outside of the Catheter into the bladder, in the same place as upon the gripe, which I could do very readily, and then I took out a stone of any size with more ease than in any other way. I forbear to give a more particular account of the manner of performing this operation, it having been done already as well as is possible by Doctor Douglas. My patients for some days after the operation seemed out of danger, but the urine which came out of the bladder continually lodging upon the cellular membrane on the outside of the Rectum,

made

made foetid ulcers, attended with a vast discharge of stinking matter, and from this cause I lost four patients out of ten: The case of one which escaped was very remarkable; a few days after he was cut, he was seized with a great pain in his back and legs, with very little power to move them; upon which he turned upon his face, and rested almost constantly upon his knees and elbows above a fortnight together, having no ease in any other posture all that while, at length his urine coming all the right way, his wound soon healed, and he recovered the use of his back and limbs. I think all these severe symptoms could proceed from no other cause than the urine and matter somehow offending the great nerves, which come out of the Os Sacrum to go to the lower limbs. I then tried to cut into the bladder, in the same manner that Mr. Rau was commonly reported to do, but there had the same inconvenience from the urine's lodging upon the cellular membrane on the outside of the Intestinum Rectum. Upon these disappointments I contrived the manner of cutting, which is now called the lateral way.

THIS operation I do in the following manner. I tie the patient, as for the greater Apparatus, but lay him upon a blanket several doubles upon an horizontal table three foot high, or a little more, with his head only raised. I first make as long an incision as I well can, beginning near the place where the old operation ends, and cutting down between the Musculus Accelerator Urinæ, and Erector Penis, and by the side of the Intesti-

num Rectum: I then feel for the staff, and cut upon it the length of the prostrate gland strait on to the bladder, holding down the gut all the while with one or two fingers of my left hand. The rest of this operation is the same as in the old way: But in this way there being often cut small vessels, I always tie them with a ligature, passed under them by the help of a crooked needle.

THE first twenty seven patients cut this way recovered, and I believe are all living at this time: Indeed I had cut thirty one who recovered before I had one died, having cut four more who recovered between the time the twenty eighth was cut, and the time he died; but I scorn to use any fallacious way of representing my success. Some of these being cut in the hospital, and some privately, the truth of this account may be suspected by those who do not know me. I cannot take the liberty to mention the names of private patients, therefore I will give a detail of those only which I cut this way in the hospital, where the first twenty five recovered, to the truth of every one of which I had above twenty witnesses, and I do believe these patients are all living at this time.

MARCH 27. 1727.

Robert Kafon	aged 4
Henry Webb	5
Francis Willsmore	15

APRIL

APRIL 12. 1727.

Hannibal Basketfeild	aged 3
Thomas Hull	4
Alexander Montgomery	8
Henry Cope	44

MAY 15. 1727.

Thomas Nailer	7
John Letheridge	8
Daniel Bezely	9

APRIL 8. 1728.

Walter Bromingham	4
William Jerfey	4
Thomas Kennet	13

APRIL

William Davis	4
Thomas Ellis	5
William Adams	6
James Bond	10

MAY 9. 1728.

John Parson	5
William Chater	11
Wilfrey Peale	40
William Haffenden	67

MAY 25. 1728.

Joseph Godwin	3
Ellis Bakewell	5

MARCH

## MARCH 21. 1725.

William Ward	aged 10
John Edwards	15
Thomas Warren	17 died.
Isaac Wood	25

## APRIL 21. 1729.

John Payne	4
Thomas March	6
Robert Caruthus	10

## APRIL 29. 1729.

Gabriel Forster.	21
Simon Sutcliffe	36
John Miles	42

## MAY 1729.

FOUR cut in the presence of Monf. Morand, one of which, named Money, died. The names of the other three I have lost.

## JULY 1. 1730.

Henry Hall	4
Walter Scott	4
John Tooting	7
John Paxter	11
Edward Eilding	13

## JULY 31. 1730.

Joseph Wright	6
Joshua Philips	7
Richard Michell	10
Daniel Hall	14

In all 46.

THOMAS



THOMAS WARREN, the first who died, had been troubled with the stone from his cradle, to the time he was cut, seventeen years old; he was very much wasted with pain, and had bad kidneys; he lived free from pain three weeks after he was cut, but his wound never digested well.

THE other, who died, named Money, had a violent whooping cough. He was removed from the hospital for the benefit of the air, and died a fortnight after the operation. Many of the children had the small-pox during their cure, and some the measles.



## CHAP. II.

*An account of some Observations made by a young gentleman who was born blind, or lost his sight so early, that he had no remembrance of ever having seen, and was couch'd between thirteen and fourteen years of age.*

**T**H<sup>O'</sup> we say of this gentleman that he was blind, as we do of all people who have ripe Cataracts, yet they are never so blind from that cause but that they can discern day from night; and for the most part in a strong light, distinguish black, white, and scarlet; but they cannot perceive the shape of any thing; for the light by which these perceptions are made, being let in obliquely through the aqueous humour, or the anterior surface of the chrystaline (by which the rays cannot be brought into a Focus upon the Retina) they can discern in no other manner, than a sound eye can through a glass of broken jelly, where a great variety of surfaces so differently refract the light, that the several distinct Pencils of rays cannot be collected by the eye into

to their proper Foci; wherefore the shape of an object in such a case cannot be at all discerned, though the colour may: And thus it was with this young gentleman, who though he knew these colours asunder in a good light, yet when he saw them after he was couch'd, the faint ideas he had of them before, were not sufficient for him to know them by afterwards, and therefore he did not think them the same which he had before known by those names. Now scarlet he thought the most beautiful of all colours, and of others the most gay were the most pleasing, whereas the first time he saw black it gave him great uneasiness, yet after a little time he was reconciled to it; but some months after, seeing by accident a negro woman, he was struck with great horror at the sight.

WHEN he first saw, he was so far from making any judgment about distances, that he thought all objects whatever touch'd his eyes, (as he express'd it) as what he felt did his skin, and thought no objects so agreeable as those which were smooth and regular, though he could form no judgment of their shape, or guess what it was in any object that was pleasing to him: He knew not the shape of any thing, nor any one thing from another, however different in shape or magnitude; but upon being told what things were, whose form he before knew from feeling, he would carefully observe, that he might know them again; but having too many objects to learn at once, he forgot many of them; and (as he said)

said) at first he learn'd to know, and again forgot a thousand things in a day. One particular only (though it may appear trifling) I will relate: Having often forgot which was the cat, and which the dog, he was ashamed to ask; but catching the cat (which he knew by feeling) he was observed to look at her stedfastly, and then setting her down, said, So pufs! I shall know you another time. He was very much surprized, that those things which he had liked best, did not appear most agreeable to his eyes, expecting those Persons would appear most beautiful that he loved most, and such things to be most agreeable to his sight, that were so to his taste. We thought he soon knew what pictures represented, which were shew'd to him, but we found afterwards we were mistaken; for about two months after he was couch'd he discover'd at once they represented solid bodies, when to that time he consider'd them only as party-colour'd planes, or surfaces diversified with variety of paint; but even then he was no less surprized, expecting the pictures would feel like the things they represented, and was amaz'd when he found those parts, which by their light and shadow appear'd now round and uneven, felt only flat like the rest, and ask'd which was the lying sense, feeling, or seeing?

BEING shewn his father's picture in a locket at his mother's watch, and told what it was, he acknowledged a likeness, but was vastly surprized; asking, how it could be, that a large face could



could be express'd in so little room, saying, it should have seem'd as impossible to him, as to put a bushel of any thing into a pint.

At first, he could bear but very little sight, and the things he saw, he thought extremely large; but upon seeing things larger, those first seen he conceiv'd less, never being able to imagine any lines beyond the bounds he saw; the room he was in he said, he knew to be but part of the house, yet he could not conceive that the whole house could look bigger. Before he was couch'd, he expected little advantage from seeing, worth undergoing an operation for, except reading and writing; for he said, he thought he could have no more pleasure in walking abroad than he had in the garden, which he could do safely and readily. And even blindness he observed, had this advantage, that he could go any where in the dark much better than those who can see; and after he had seen, he did not soon lose this quality, nor desire a light to go about the house in the night. He said, every new object was a new delight; and the pleasure was so great, that he wanted ways to express it; but his gratitude to his operator he could not conceal, never seeing him for some time without tears of joy in his eyes, and other marks of affection: And if he did not happen to come at any time when he was expected, he would be so griev'd, that he could not forbear crying at his disappointment. A year after first seeing, being carried upon Epsom Downs, and observing a large prospect

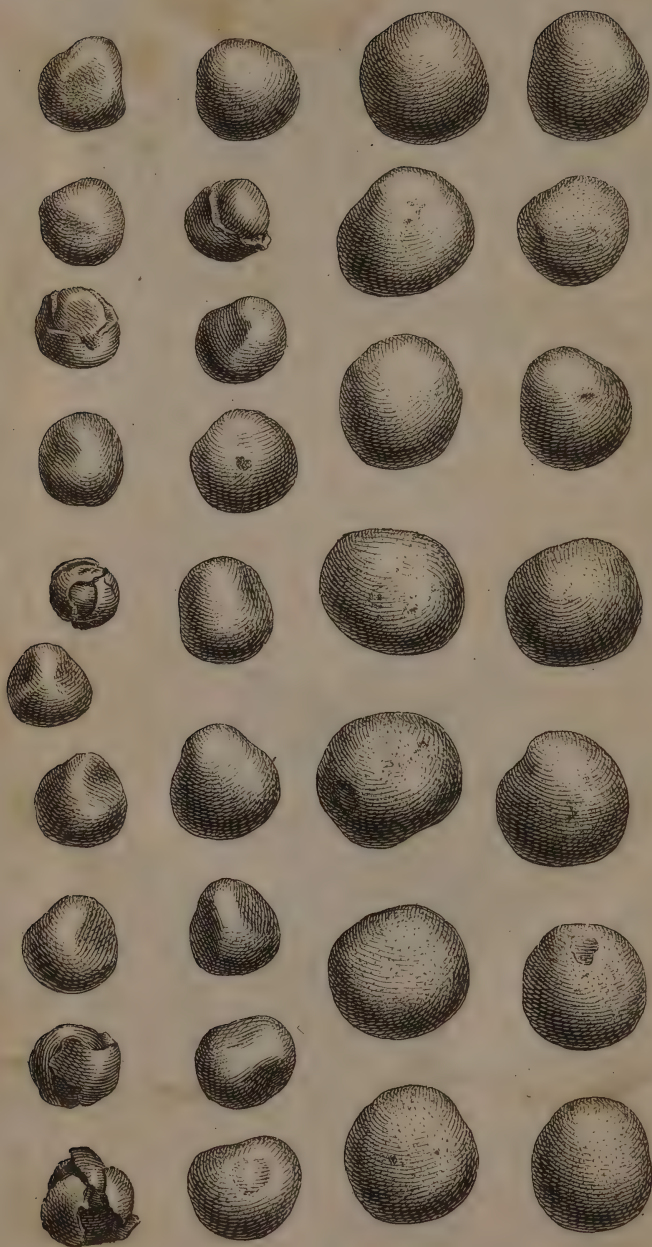


spect, he was exceedingly delighted with it, and call'd it a new kind of seeing. And now being lately couch'd of his other eye, he says, that objects at first appear'd large to this eye, but not so large as they did at first to the other; and looking upon the same object with both eyes, he thought it look'd about twice as large as with the first couch'd eye only, but not double, that we can any ways discover.

I HAVE couch'd several others who were born blind, whose observations were of the same kind; but they being younger, none of them gave so full an account as this gentleman.







T A B L E I.

THIRTY three stones taken from William Haffenden, in the sixty eighth year of his age. The next day after he was cut, the measles appeared, which he had in a very severe manner. He is now living at Gravesend. (Vid.) page 245, line 20.



A a

TABLE

## TABLE II.

A STONE which weighed eleven ounces, and measured ten inches round, taken from John Miles, who is now living at Reading. (Vid.) page 346, line 11.



TABLE



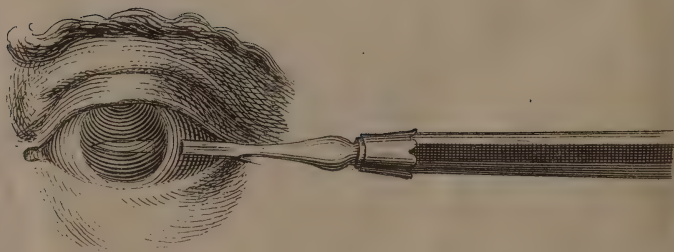
*Appen.*

TAB. II.









## T A B L E III.

THREE figures of eyes to explain an operation, which I invented some years ago, and printed a short account of in the Philos. Transf. and have often practised with success. The distemper for which this operation is performed, is either a total closure of the pupil, which is sometimes natural, and sometimes happens from inflammations; or else when the pupil is extremely contracted, and the inner edges of the Iris growing to a cataract, or part of a cataract after couching. The manner of doing this operation is thus; the eyelid being firmly held open by an instrument, a small knife or needle, edged on one side, is thrust through the Tunica Sclerotis, as in the lower figure; and then forwards through the Iris, the edge being turned to the Iris; in drawing of it out, a slit is cut as in the two upper figures. When this distemper is without a cataract, it is best to make the operation in the middle, as in the upper one; but if there is a cataract, or part of a cataract, then to make it higher, that the cataract may not obstruct the light. These cataracts are generally very small, and sometimes by reason of their adhesion not to be removed. The aperture in the middle eye, was made lower than the center of the Cornea, there being an Albugo on the upper part of it, which made it unfit to perform the operation in that part.

F I N I S.







*James*

32,593





